Adaptec Storage Manager Pro for DuraStor

User's Guide

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1

Getting Started

In This Chapter

Adaptec Storage Manager^{TM} Pro for DuraStor is a storage management software application that manages the storage devices connected to your Adaptec DuraStor external RAID controller(s). You can create and reconfigure arrays, manage spares, monitor the status of your storage devices, and more.

You can access newly created arrays immediately after creating them.

Storage Manager Pro also allows you to perform all these functions for all systems on your network that are running Storage Manager Pro. This gives you the power you need to manage all your storage devices from a single location.

Storage Manager Pro runs under Windows NT$^{®}$, Windows$^{®}$ 2000, and Solaris 8.

About This Guide

This *User's Guide* describes the features available in Storage Manager Pro and how to use them. It assumes that you are familiar with the basic functions of your operating system such as using your mouse to select information, using menus, and scrolling. If you are not familiar with these functions, refer to your operating system's documentation.

This *User's Guide* also assumes that you are familiar with basic network administration terminology and tasks and that you have some knowledge of Redundant Array of Independent Disks (RAID).

Conventions

This *User's Guide* uses several typographical conventions to help explain how to use Storage Manager Pro.

Convention	Description
Bold	Words in **bold** indicate items to select such as menu items or command buttons.
Sans serif	Words in a sans serif font indicate file names and path names.
Courier	Words in the Courier font indicate commands or text you type exactly as shown.
	Notes give you important information that may affect how you decide to set up your system.
	Cautions warn you about actions that may permanently delete data or cause damage to your system.

Getting Online Help

Online Help is available at any time from the Help menu. You can also press **F1** or click **Help** in a dialog box to display Online Help specific to where you are.

Starting Adaptec Storage Manager Pro

For information about installing Storage Manager Pro, refer to the *DuraStor Installation and User's Guide* for your controller.

When you install Storage Manager Pro, the Adaptec Storage Manager Pro service (ASMProServer) starts automatically and starts each time you boot your system. This service must be running for Storage Manager Pro to permit remote access to the system, for notification and event logging, and for the user interface to work.

Checking to See If the Service Is Running

If you ever start the Storage Manager Pro user interface and receive an error message (cannot connect to local server), check that the service is running.

■ Windows NT/2000—Click **Start**, point to **Settings**, click **Control Panel**, double-click **Services**.

■ Windows 2000 Server and Advanced Server—Click **Start**, point to **Settings**, click **Control Panel**, double-click **Administrative Tools**, double-click **Services**.

The ASMProServer should be listed as Started and you should see the Storage Manager Pro icon on your screen.

The service will be shut down automatically when you uninstall Storage Manager Pro or during normal shutdown.

Starting the Service Manually

If the Storage Manager Pro service is not running, start it manually:

■ Windows NT—Click **Start**, point to **Settings**, click **Control Panel**, and double-click **Services**. Select **ASMProServer**, and click **Start**.

■ Windows 2000—Press **Ctrl+Alt+Delete** to open the Windows Security dialog box. Click **Task Manager**, then click the **Processes** tab. From the File menu, select **New Task (Run...)**. Type or browse for the path to ASMProServer.exe and click **OK**.

■ Solaris 8—Type:

`/opt/StorageManagerPro/ASMProServer.sh start`

The command *is* case-sensitive.

Starting Storage Manager Pro On Windows

You start Adaptec Storage Manager Pro from the Start menu, just like other Windows applications.

If you want to display Storage Manager Pro in a language other than English, you must click **Start**, point to **Settings,** click **Control Panel,** double-click **Regional Settings**, and select the language you want.

To start Storage Manager Pro on Windows:

1 Click **Start**, point to **Programs,** point to **Adaptec Storage Manager Pro,** and select **Adaptec Storage Manager Pro**.

The Adaptec Storage Manager Pro Login dialog box appears.
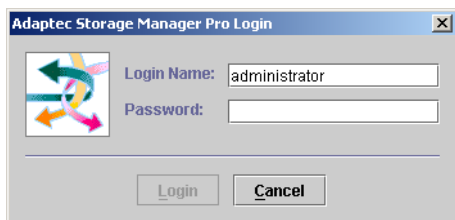
2 Type your Login Name.

If this is the first time you are logging in, type `administrator` to use the default user account that comes with Storage Manager Pro. Login names are not case sensitive.

3 Type your Password.

Use the password you created during installation. Remember that passwords *are* case sensitive.

4 Click **Login**.

If this is the first time you are logging in or you are working locally, the System Browser window appears with the Dashboard behind it. From the System Browser window, you can access the array creation and related functions.

If you have already set up remote access to other systems, only the Storage Manager Pro Dashboard appears. From the Dashboard, you can access all of the Storage Manager Pro functions. Click **Open System** to access the System Browser for the selected system. See *Understanding the Dashboard* on page 1-6.

Most steps in this *User's Guide* start from the System Browser window.
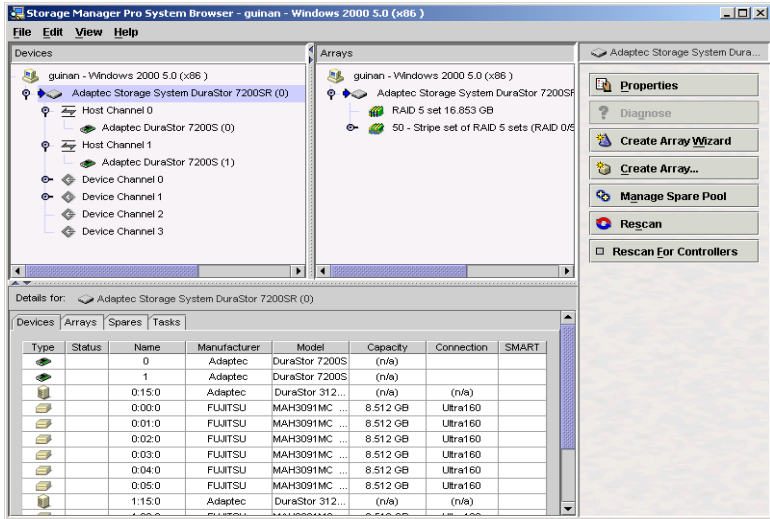
Starting Storage Manager Pro on Solaris

To start Storage Manager Pro on Solaris:

1 Change directories to where you installed Storage Manager Pro.

2 Type the following:

```
./ASMPro
```

The command *is* case-sensitive.

The Adaptec Storage Manager Pro Login dialog box appears.

3 Continue with Step 2 on page 1-4.

Understanding the Dashboard

The Dashboard appears when you start Storage Manager Pro. If you are working locally only, the Storage Manager Pro Dashboard is behind the System Browser window.

If you have already set up remote access to other systems, only the Storage Manager Pro Dashboard appears when you start Storage Manager Pro.

System Filter box

Icon showing directory manager

Icon showing member of management set

Command Buttons pane
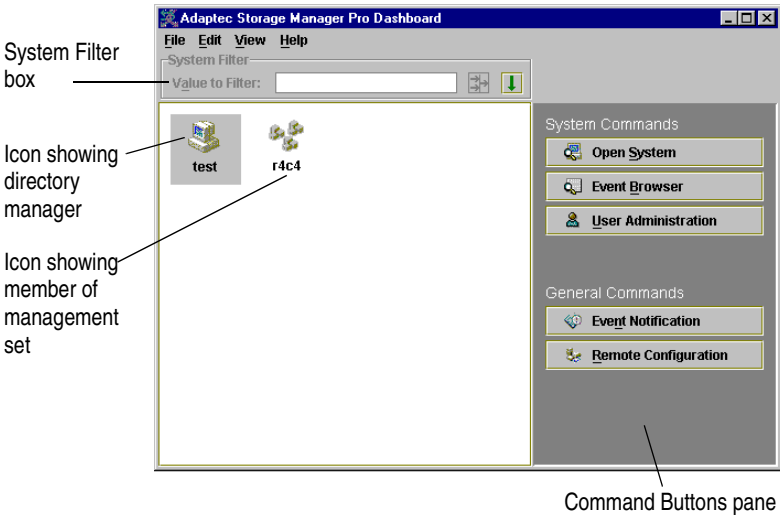
The Dashboard allows you access to all of the Storage Manager Pro functions from the Command Buttons pane. This area is divided into two sections, *System Commands* and *General Commands*.

System Commands

These commands are applicable only to the selected system:

■ Open System (System Browser)—Allows you to create and reconfigure arrays, and manage disk drives, spares, controllers, and enclosures. See *Understanding the System Browser* on page 1-9.

■ Event Browser—Allows you to view Storage Manager Pro events for the selected system. See *Viewing Events* on page 6-2.

■ User Administration—Allows you to set up Storage Manager Pro login names and passwords. See Chapter 5, *Managing Storage Manager Pro Users*.

General Commands

These commands apply to Storage Manager Pro, rather than to a specific system:

■ Event Notification—Allows you to set up e-mail and e-mail pager notification so you can be informed about specified events, such as failovers, that may occur on your DuraStor external RAID controller. See *Setting Up Event Notification* on page 6-7.

■ Remote Configuration—Allows you to set up remote access to other systems running Storage Manager Pro that are on your network. See Chapter 4, *Managing Controllers on Remote Systems*.

Changing How the Dashboard Looks

You can control how the Dashboard looks by selecting these options from the View menu:

■ Normal View—This is the default view. View the icons or the details for all systems in the management set. The Normal view is shown in the figure on page 1-10.

■ OS View—This option shows a tab for each operating system used by your systems. View all the systems using a specific OS by selecting the appropriate tab.

■ Status View—This option shows a tab for each status: OK, Warning, and Critical. View systems by status by selecting the appropriate tab.

■ Detail View—This option shows details, rather than icons, for each system. The details include: System Name, OS Type, OS Version, IP Address, and whether the system is the Directory Manager.

■ Sort By—View systems sorted by Local System, Directory Manager, System Name, IP Address, or System Status. This item is not available on the View menu when you are in the Detail view. From the Detail view, you can click on the table headers to

sort system by status, directory manager, IP address, system name, OS type, and OS version.

■ Toolbar—This option replaces the Command Buttons pane with a toolbar, giving you more room to see systems or details. The toolbar can be viewed with icons only or with icons and text.

■ Large Icon—This option lets you view larger versions of the icons. This is selected by default. To view the smaller icons, clear the check box for this option.

■ Refresh—View an updated representation of your selection. This is useful, for example, when you have taken a system down for repair, then brought it back up.

Using System Filters

You can use a filter to control which system you view. You can select a system by name or by IP Address.
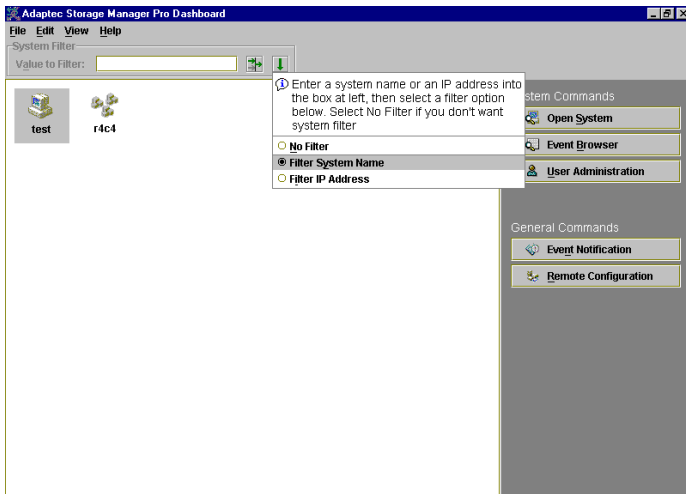
You can also select a group of systems to view by using the following wildcard operators:

■ * is a string wildcard that matches 0 or more characters in the query.

■ ? is a single-character wildcard that matches any single character in the query.

You can position wildcard operators at the beginning, middle, or end of a query word and you can combine them within a word; for example, ?yst*.

Type	Return
jo?	Systems with 3-letter names beginning with "jo," such as joe, jon, etc.
jo*	All systems beginning with the letters "jo," such as joe, john, jones
162.1?9.222.111	Systems with any single character in the place of the question mark, such as 162.109.222.111, 162.119.222.111, 162.129.222.111, and so on.
162.*	All systems with the address prefix 162

Understanding the System Browser

When you start Storage Manager Pro, the System Browser window appears automatically only if you are working locally.

If you have already set up remote access to other systems, only the Storage Manager Pro Dashboard appears when you start Storage Manager Pro. You must select a system and click **Open System** or double-click a system icon to display the System Browser window.

The System Browser is where you perform most of your storage management functions. From the System Browser you can:

■ Create and reconfigure arrays. See Chapter 2, *Creating an Array* and Chapter 3, *Managing Arrays*.

■ Monitor task progress and controller events. See Chapter 6, *Monitoring System Status*.

■ Add and remove spares. See Chapter 7, *Managing Spares*.

■ Rescan controllers. See Chapter 9, *Managing Controllers*.

■ Turn off alarms and check enclosure status. See Chapter 10, *Managing Storage Enclosures*.

System Browser Window Parts

When you first open the System Browser window, you can see the system you opened and the first controller in the Devices pane.
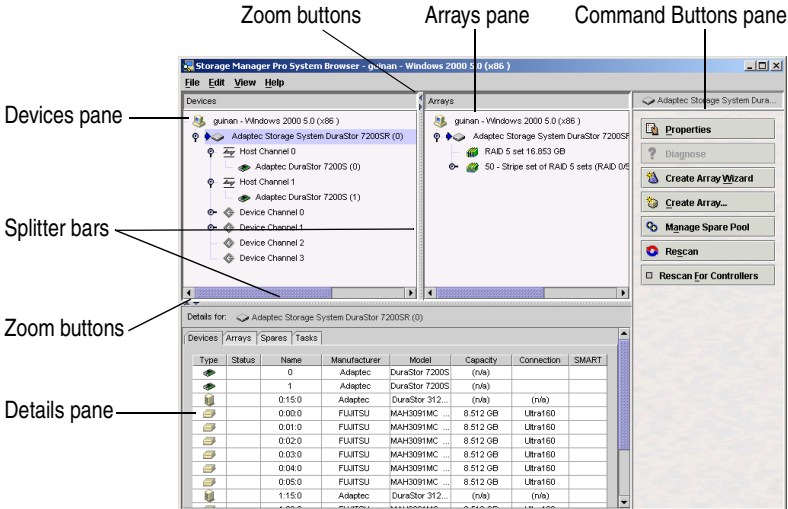
The primary parts of this window are:

■ Devices pane—Shows a hierarchical view of the physical devices attached to the system that is at the top of the hierarchy. You can expand and collapse the tree. See *Navigating the System Browser Window* on page 1-11.

■ Splitter bar—Resizes the height or width of the Devices, Arrays, Command Buttons pane, and Details panes.

■ Zoom buttons—Click a button to move the splitter bar to its extreme upper or lower position.

■ Details pane—Shows the details about the device or array selected in the top part of the window. Refer to the Online Help for detailed information about each tab. You can also select items in the Details pane and perform functions associated with the selected item. The buttons in the Command Buttons pane change to reflect the functions you can perform.

■ Command Buttons pane—Lists the available functions for the selected item in the Devices, Arrays, or Details pane. The buttons change based on the item selected. You can also right-click a selected item to see the active functions.

■ Arrays pane—Shows all arrays created on all controllers on the open system.

Navigating the System Browser Window

The System Browser window works the same as Windows Explorer and other tree-type lists. It shows a hierarchical view of the physical devices connected to the system, along with existing arrays.

When you select a device or array, information related to that device or array is displayed in the Details pane. In the figure on page 1-10, the controller is selected in the Devices pane. The Devices tab in the Details pane lists each physical device connected to the controller and information about each device. The Arrays tab lists the arrays on the selected controller and their information.

When you select an array in the Arrays pane, more information about the array is displayed in the Details pane. See page 1-12.

Arrows associate selected item with devices in opposite pane. Here they show the disk drives associated with the selected array.

Selected item shown by highlight and label. If the label above the buttons is truncated, hold your mouse over the label to see a tooltip with complete information. For some controllers, raw drives are made available to the operating system as volume set arrays.

Turner—Click to expand or collapse the devices hierarchy.

Array size.

Array type icon and array name.
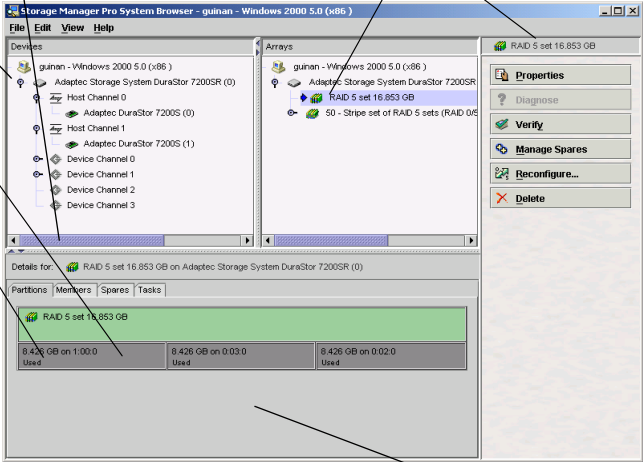
Partitions that make up the array showing space allocated to the array (Used). If the display is truncated, hold your mouse over the partition to see a tooltip with the complete information.

System Browser Icons

Each type of device and array has its own icon in the System Browser window as shown in the following table.

Icon	Device	Icon	Array Type
	System		Volume set (JBOD)
	Directory Manager		Stripe set (RAID 0)
	Storage System		Mirror set (RAID 1)
	Controller		RAID 3, 4, or 5 set
	Fibre Channel		Stripe set of mirror sets (RAID 0/1)
	SCSI Channel		Stripe set of RAID 5 sets (RAID 0/5)
	Enclosure		
	Disk drive		
	Uninitialized disk drive		

The Status column for each device in the Details pane displays an indicator that changes based on the condition of the device. For more information, see *Understanding the Details Pane Status Column* on page 6-7.

Changing How the System Browser Looks

You can control two aspects of how the System Browser window looks using the View menu:

■ Size of the device and array icons—Allows you to use small or large icons. The small icons permit more devices and arrays to display in the window without scrolling.

■ Whether the Command Buttons pane is displayed—Allows you to show or hide the Command Buttons pane. The functions are still available when you right-click a selected device or array.

Uninstalling Storage Manager Pro On Windows

Use Add/Remove Programs from the Control Panel. You must have administrator privileges.

When you uninstall Storage Manager Pro on Windows 2000 and during normal shutdown, the Storage Manager Pro service (ASMProServer) will be shut down automatically. For Windows NT, you need to stop the service from the Control Panel.

Note: If all the files are not deleted during the uninstall process, open Windows Explorer. Open Program Files, and click on the **Adaptec** folder, then delete the **Storage Manager Pro** folder.

Uninstalling Storage Manager Pro On Solaris

To uninstall Storage Manger Pro:

1 Go to the directory where Storage Manager Pro is installed. The default directory is:

/opt/StorageManagerPro

2 Type:

uninstall_smpro.sh

The InstallAnyWhere Uninstaller dialog box appears.

3 Follow the on-screen instructions.

2

Creating an Array

In This Chapter

An *array* is one or more physical disk drives that appear as a single device (logical drive) to the user. You create arrays from one or more physical disk drives.

You can create an array on any disk drive on your local system that is connected to a controller managed by Storage Manager Pro. You can also create arrays remotely on systems that you can access using your network. Storage Manager Pro must be installed and running on the remote system. See Chapter 4, *Managing Controllers on Remote Systems*.

You can create an array two different ways depending on whether you want to customize the array creation settings:

■ Using the wizard—The Create Array Wizard guides you through determining the best array configuration for your needs. See *Creating an Array Using the Wizard* on page 2-2.

■ Using the Create Array dialog box—You can customize the array creation settings including the array size and selected disk drives. You can also select spares if your controller supports dedicated spares, and change the default array creation properties. See *Creating a Custom Array* on page 2-5.

To create an array using either method, you must perform the following tasks in sequence:

1 Create the array. See *Creating an Array Using the Wizard* on page 2-2 or *Creating a Custom Array* on page 2-5.

2 Make the array available for use. See *Making the Array Available for Use* on page 2-12.

> **Caution:** You should not remove a disk drive that is used by an array. This may cause you to lose data. See *Replacing a Failed Disk Drive in an Array* on page 3-1.

For information describing each array type, see *Array Types* on page A-7. For information about selecting an array type, see Appendix B, *Choosing Your Array Type*.

> **Note:** Storage Manager Pro is based on the SCSI-2 specification which defines a 2TB maximum array size. Storage Manager Prodoes not support arrays larger than 2TB.

Creating an Array Using the Wizard

The Create Array Wizard guides you through determining the best array configuration settings for your needs, creates an array based on your selections, and uses all the available disk drives on the controller.

> **Note:** If the boot drive is connected to the RAID controller, Adaptec does not recommend using the Wizard.

If you want to select specific disk drives or customize the array, click **Advanced** to open the Create Array dialog box.

If you don't customize the array, the Create Array Wizard attempts to use all available disk drives and creates either a RAID 0, RAID 1, or RAID 5 array.

Storage Manager Pro is based on the SCSI-2 specification which defines a 2TB maximum array size. Storage Manager Pro does not support arrays larger than 2TB

To create an array using the Create Array Wizard:

1 In the System Browser window, select the controller or storage system where you want to create the array.

2 Click **Create Array Wizard**.

The Create Array Wizard appears and guides you through the following array configuration criteria, each of which is defined in the Wizard:

– Determine Fault Tolerance and Failover Drive (Spare)

– Determine Array Performance: Array Stripe Size

– Verify Array Creation Configuration

Based on the criteria you select, the Create Array Wizard will suggest the type of array to create as well as other array configuration settings that are appropriate for your situation.
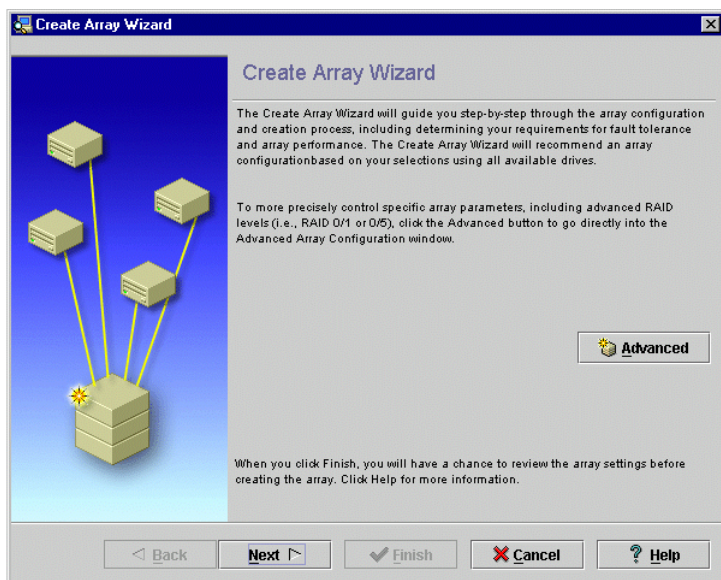
3 Follow the on-screen instructions.

Click **Next** to go to the next configuration criterion or click **Finish** at any time to create the array. The Create Array Wizard will determine the type of array to create based on the available disk drives on your controller and any criteria you have specified.

4 Click **Finish** when you are ready to create the array.

The Verify Array Creation Configuration dialog box appears.

5 Type the Array Name.

This is the name Storage Manager Pro will use to display the array in the System Browser window. The name can be up to 20 characters in length.

If you leave Array Name field blank, the array will have no name.

6 Review the settings in the Verify Array Creation Configuration dialog box to be sure the array is configured the way you want it.

Click **Back** if you want to change any of the array configuration settings before creating the array.

7 Click **Finish** to create the array as described.

The system creates the array using your selections and adds the array to the System Browser window. You can begin using the array while Storage Manager Pro completes the Build process. The Build task may take several hours to complete, depending on the array type, size of the array, and I/O load.

Before you can write data to the array, you need to make the array available for use. See *Making the Array Available for Use* on page 2-12.

To add a spare disk drive, see *Adding a Disk Drive to the Spare Pool* on page 7-5, or *Adding a Spare to an Array* on page 7-2.

Creating a Custom Array

From the Create Array dialog box, you can customize the following array settings. Each is explained in the steps in this section.

■ Array name

■ Array type

■ Selected disk drives

■ Spares assigned to the array

To create a custom array:

1 In the System Browser window, select the controller or storage system where you want to create the array.

2 Click **Create Array**.

– Alternate method: In the Details pane, select one or more disk drives you want to use for an array and click **Create Array**.

The Create Array dialog box appears.
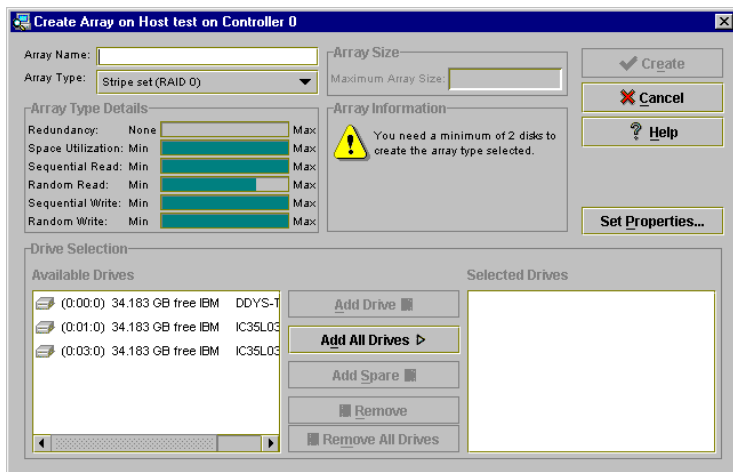
3 Type the Array Name.

This is the name Storage Manager Pro will use to display the array in the System Browser window. The name can be up to 20 characters in length.

If you do not want to name the array, leave this field blank.

4 From the drop-down list box, select an Array Type.

For a description of each available type, see Appendix A, *General Storage Concepts*. For assistance making your selection, see Appendix B, *Choosing Your Array Type*.

The Array Information section of the dialog box displays information about the array you are creating. The Array Type Details section of the dialog box shows how the array type ranks in each of six array characteristics. For definitions of the characteristics, see *Understanding the Array Selection Criteria* on page B-7.

5 Select the disk drives you want to use for the array:

– See the Array Information section of the dialog box for the number of disk drives you can use to create the array type you selected.

– If you selected one or more disk drives in the Details pane and clicked **Create Array**, the disk drives you selected are listed in the Selected Drives list. To add disk drives, select one or more from the Available Drives list and click **Add Drive**. You can also double-click a disk drive.

– To select more than one disk drive, press and hold the **Ctrl** key and click each drive. To select all the available disk drives, click **Add All Drives**.

– The disk drives you selected move to the Selected Drives list and display a yellow asterisk showing that they are new disk drives for this array. See *Understanding the Selected Disk Drive Icons* on page 2-9.

– See the Array Information section of the dialog box for information about how much space will be used on each disk drive. This information is displayed for all array types except a volume set.

– In the Array Size section, Storage Manager Pro displays the size of the array based on the type of array and size of the disk drives you select.

6 If you want to assign spare disk drives to this array, select one or more disk drives in the Available Drives list and click **Add Spare**.

You can only assign spare disk drives for redundant array types (mirror set [RAID 1], RAID 3 set, RAID 4 set, RAID 5 set, stripe set of mirror sets [RAID 0/1], or stripe set of RAID 5 sets [RAID 0/5]).

This assigns the selected disk drives as dedicated spares for this array. See Chapter 6, *Monitoring System Status*. The disk drives you selected move to the Selected Drives list and display a spare icon and yellow asterisk showing that they are new spares for this array. See *Understanding the Selected Disk Drive Icons* on page 2-9.

7 If you want to view or change the array default properties, click **Set Properties**.

The Default Array Creation Properties dialog box appears. Change the settings as needed and click **Save**. See *Viewing and Setting the Default Array Creation Properties* on page 2-10.

8 Click **Create**.

The Verify Create Array Settings dialog box appears listing the settings for the array Storage Manager Pro will create.
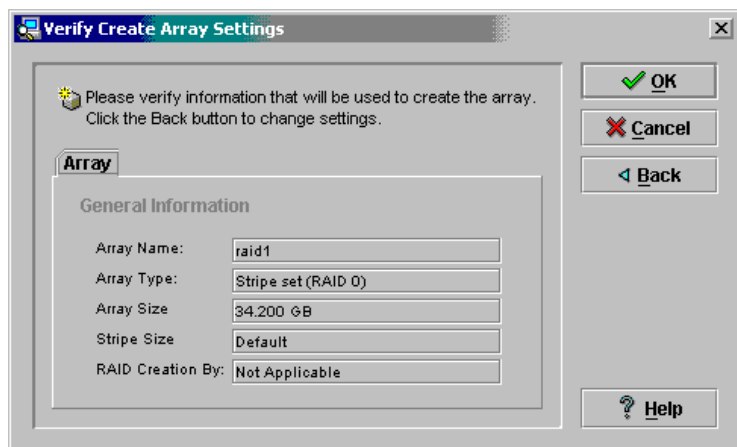
If you are building a stripe set of RAID 5 sets (RAID 0/5), you will see an additional tab, RAID 0/5. Depending on the number of disk drives you have selected, the tab allows you to select the number of RAID 5 sets you want to use to create the RAID 0/5 set. For example, if you select 15 disk drives, you can create a RAID 0/5 striped across either three RAID 5 sets (each containing five disk drives) or five RAID 5 sets (each containing three disk drives). From the RAID 0/5 Configuration drop-down list box, select the Number of RAID 5 sets you want to stripe across.

9 Check each tab of the dialog box to be sure the array settings are the way you want them.

Depending on the array type, you'll have one to two tabs of information to verify.

If you want to change the settings for the array before creating it, click **Back**. Storage Manager Pro returns to the Create Array dialog box.

10 Click **OK** to create the array as listed.

A dialog box appears telling you that you may need to reboot for your operating system to see the array.

11 Click **OK**.

Storage Manager Pro creates the array using your selections, and adds it to the System Browser window. The array creation task may take several hours to complete, depending on the array type, size of the array, and the I/O load. See *Viewing Task Progress* on page 6-4.

Before you can write data to the array, you need to first make the array available for use. See *Making the Array Available for Use* on page 2-12.

Caution: If you click **Cancel**, the array will not be created. To leave this dialog box and continue to create an array, click **Back**.

Understanding the Selected Disk Drive Icons

When you select disk drives for your array in the Create Array or Reconfigure Array dialog boxes, Storage Manager Pro uses different icons to denote the new and already selected disk drives.

Icon	Definition
	Available disk drive
	New selected disk drive—drive that you just assigned to an array
	Selected disk drive—drive that was already assigned to an array
	New selected spare disk drive— drive that you just assigned as a spare to an array
	Selected spare disk drive—drive that was already assigned as spare to an array

Viewing and Setting the Default Array Creation Properties

You can view and set the default array creation properties that Storage Manager Pro uses to create arrays. You access the properties from the Create Array dialog box.

Storage Manager Pro saves these settings, associates them with your user account, and uses them whenever you create an array.

To view or set the default array creation properties:

1 From the Create Array dialog box, click **Set Properties**. See *Creating a Custom Array* on page 2-5.

The Default Array Creation Properties dialog box appears. (The Array tab may show different information depending on the array type.)
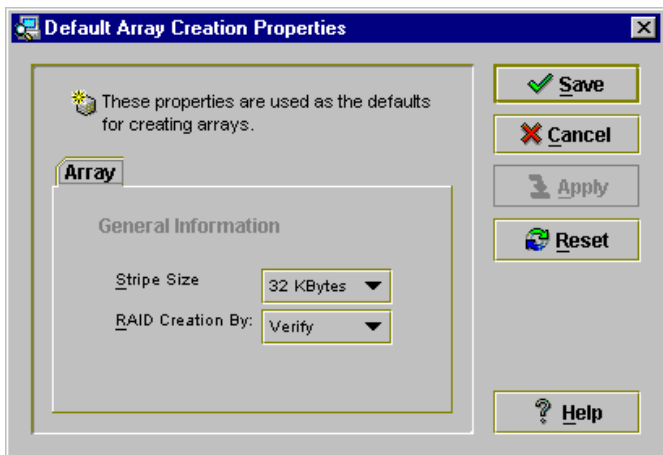
2 Change the following properties:

| Property	Description
Stripe Size	Sets the amount of data written to one array partition before the controller moves to the next array partition in a stripe set (RAID 0), RAID 3 set, RAID 4 set, RAID 5 set, stripe set of mirror sets (RAID 0/1), or stripe set of RAID 5 sets (RAID 0/5). See *Stripe Size* on page 2-11.
RAID Creation By	Shows the method used to create the array. Some controllers let you change the RAID creation method to either Verify or Zero.
	Verify: Storage Manager Pro uses the Verify method by default when it creates the array. The Verify method reads all the data on the drives in the array and resets the parity (redundancy) of the existing data sequentially from the beginning of the array to the end. The array is available to users during the Verify process.
	Zero: Completely deletes all data on the drive before creating the array. Zero is faster than the Verify option. If your drives support it, the Zero is done in parallel on all of the arrays' partitions, resulting in an even faster process. However, the array is not available to users until the Zero is completed.

3 Click **Save** to save the changes and return to the Create Array dialog box.

Storage Manager Pro saves your changes, which are associated with your user account. Storage Manager Pro uses these settings whenever you use your user account to create an array.

Stripe Size

Stripe size is the amount of data written to one disk drive before the controller moves to the next disk drive in a stripe set (RAID 0), RAID 3 set, RAID 4 set, RAID 5 set, stripe set of mirror sets (RAID 0/1), or stripe set of RAID 5 sets (RAID 0/5).

Storage Manager Pro uses the default stripe size (64k) recommended by the DuraStor external RAID controller. This is generally the best stripe size to use. The other stripe size options are 16k and 64k.

Note: For a RAID 5 set, use a stripe size of 64k for optimum performance.

The following list shows some guidelines to use to decide if you want to change the stripe size.

If you want better	Make the stripe size
Random I/O performance	Large relative to I/O size
Large sequential I/O performance	Small relative to I/O size

Note: Stripe size in a stripe set of RAID 5 sets (RAID 0/5) cannot exceed one megabyte. If you select a RAID 0/5 configuration which exceeds the one megabyte limit, Storage Manager Pro prompts you to revise the stripe size or reduce the number of RAID 5 sets.

You can set the default stripe size to use in array creation in the Default Array Creation Properties dialog box. See *Viewing and Setting the Default Array Creation Properties* on page 2-10.

Making the Array Available for Use

After you create an array, you typically make the array available to users. In some cases, you may need to reboot the system before the array can be accessible. Refer to your operating system's documentation for more information.

To make the array available for use in Widnows, you must partition it, assign it a drive letter, and format it. Refer to the documentation for Windows NT Disk Administrator or Windows 2000 Disk Manager for more information. You may need to rescan the controller before the array becomes available.

To make the array available for use in Solaris, you must format it, create a file system, and mount it. Refer to your operating system's documentation.

3

Managing Arrays

In This Chapter

Storage Manager Pro allows you to change many of your array settings without losing your data. Some changes take several hours to complete, depending on the array type, size of the array, the changes you made, and the I/O load. However, you can continue using the array while Storage Manager Pro makes the changes.

Replacing a Failed Disk Drive in an Array

Failover occurs when you have a spare assigned to the spare pool, an array, or if you have the dynamic spares option enabled, and the spare disk drive takes over for a failed drive. If failover has occurred, then the data in your redundant array was automatically rebuilt on the spare disk drive that took over for the failed disk drive. This is the benefit of using redundant array types and assigning spares.

You must regularly check the Storage Manager Pro log to see if a failover has occurred, especially if Event Notification is not set up. See *Monitoring Events* on page 6-1.

In a failover situation, your arrays are intact and functioning properly, but you still need to replace the disk drive that went bad and caused the failover.

> **Note:** Remember that failover is only available for redundant array types: mirror set (RAID 1), RAID 3 set, RAID 4 set, RAID 5 set, stripe set of mirror sets (RAID 0/1), or stripe set of RAID 5 sets (RAID 0/5).

To replace a disk drive if failover has occurred:

1 Remove the failed disk drive.

Refer to the *DuraStor Installation and User's Guide*.

2 Install the new disk drive.

Refer to the *DuraStor Installation and User's Guide*.

3 Rescan the controller.

See *Rescanning a Controller* on page 9-2.

4 Add the new disk drive as a spare.

See *Adding a Spare to an Array* on page 7-2 or *Adding a Disk Drive to the Spare Pool* on page 7-5. See also *Enabling Dynamic Spares* on page 7-6.

Viewing Array Capacity

You can view array capacity in two ways:

■ From the System Browser window. See the steps that follow.

■ From the Array Properties dialog box. See *Viewing Array Properties* on page 3-9.

> **Note:** The capacity shown in Storage Manager Pro reflects only the amount of space allocated to the array. It does not reflect how much space actually contains user data.

To view array capacity from the System Browser window:

1 In the Arrays pane, select the array whose capacity you want to view.

2 In the Details pane, click the **Partitions** tab.

The Partitions tab shows the array capacity and the size of each partition that makes up the array.

Expanding Array Capacity

You can expand array capacity by adding more disk drives to the array.

> **Note:** You cannot reduce the capacity of an existing array; you can only expand it. To reduce capacity, you must create a new array and copy the data from the old array using your operating system's copy function. You can then delete the old array. See *Deleting an Array* on page 3-7.

You can only add disk drives to a stripe set (RAID 0), RAID 3, RAID 4, or RAID 5 set on systems using the NTFS file system or on Solaris.

Any added disk drives must have sufficient free space for Storage Manager Pro to create a properly-sized partition for the array. Disk drives that do not have any free space are not displayed in the Available Drives list in the Reconfigure Array dialog box.

After you expand the size of the array, you must also use Windows NT Disk Administrator or Windows 2000 Disk Manager to make the additional space available to users.

To add disk drives to an array:

1 In the System Browser window, select the array where you want to add disk drives.

2 Click **Reconfigure**.

   The Reconfigure Array dialog box appears. The Selected Drives list shows the current disk drives for the array.

3 Select the disk drives you want to add:

– To add disk drives, select one or more in the Available Drives list and click **Add Drive**. The disk drives you selected move to the Selected Drives list and display a yellow asterisk showing that they are new disk drives for this array. See *Understanding the Selected Disk Drive Icons* on page 2-9.

– To add all available disk drives, click **Add All Drives**.

– To select more than one disk drive, hold the **Ctrl** key and click each drive.

– See the Array Information section of the dialog box for disk drive status.

4 Click **Reconfigure**.

Storage Manager Pro reconfigures the array using your selected disk drives. You can continue using the array while Storage Manager Pro reconfigures it even though the reconfiguration may take several hours to complete, depending on the array type, size of the array, and the I/O load. See *Viewing Task Progress* on page 6-4.

After you expand the size of an array, you must also use Windows NT Disk Administrator or Windows 2000 Disk Manager to make the additional space available to users.

Note: If you are adding disk drives to a RAID 5 set, your data will not be redundant until the reconfiguration process is completed.

Changing Array Settings or Properties

Note: As a precaution, you should back up array data before making changes to the array.

You can change the following array settings or properties:

■ Array Size. See *Expanding Array Capacity* on page 3-3.

■ Array Name. See *Changing the Array Name* on page 3-5.

- Array LUN. See *Changing the Array LUN* on page 3-6.

- Preferred Controller. See *Changing the Preferred Controller* on page 9-12.

- Write-back cache. See *Locking the Write-Back Cache Setting* on page 3-6.

- Spare disk drives. See *Changing Dedicated Spare Disk Drives* on page 3-7.

Changing the Array Name

You can change the name of your array in the Array Properties dialog box. If you do not want to name the array, you can leave the field blank.

To change the array name:

1 In the System Browser window, select the array you want to rename.

2 Click **Properties**.

The Array Properties dialog box appears.
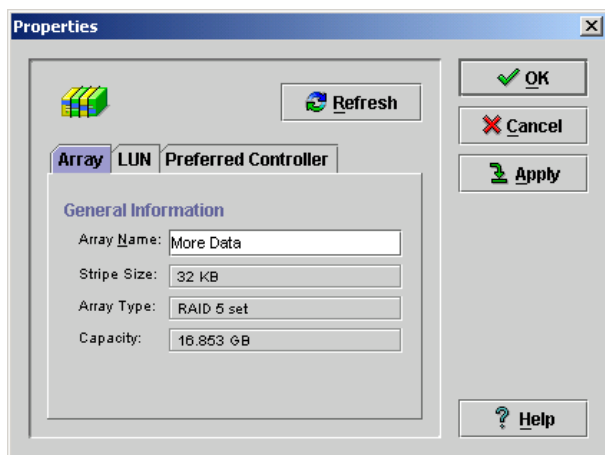
3 Type the new Array Name.

The name can be up to 20 characters in length.

4 Click **OK**.

Storage Manager Pro changes the name immediately and the new array name appears in the System Browser window.

Changing the Array LUN

You can change the LUN assigned to an array, as it appears under the controller's target ID from the host system's point of view.

> **Note:** You cannot change the array's LUN to one that is already in use. If you want to use a LUN that is already in use, you must first reassign the LUN in use.

To change the array LUN:

1 In the System Browser window, select the array whose LUN you want to change.

2 Click **Properties**.

The Array Properties dialog box appears.

3 Click the **LUN** tab.

4 From the Set Array LUN drop-down list, select the LUN you want.

5 Click **OK**.

Storage Manager Pro changes the LUN immediately.

Locking the Write-Back Cache Setting

You can prevent host systems from using SCSI mode-select commands to change the controller's write-back cache setting. Some operating systems disable the write cache. If the cache lock is enabled, the host cannot modify the write-back cache setting. The default setting is *disabled*.

This option is useful in some environments where the host system disables the controller's write-back cache, resulting in degraded performance.

To lock the write-back cache setting:

1 In the System Browser window, select the controller where you want to lock the cache.

2 Click **Properties**.

The Controller Properties dialog box appears.

3 Click the **Cache** tab.

4 Select the **Lock cache to prevent change by host system** check box.

5 Click **OK**.

The write-back cache lock setting is enabled.

Changing Dedicated Spare Disk Drives

You can use the Add Spare button in the Reconfigure Array dialog box to change the spare disk drives assigned to an array if you are also making other changes to the array.

However, if all you want to do is change the spare disk drives assigned to an array, don't do so from the Reconfigure Array dialog box. (See *Managing Spares Assigned to an Array on page 7-2* instead.) Although the Add Spare button always appears to be active, it won't add a spare to an array unless other changes are being made to the array as well.

> **Note:** Assigning a spare to an array does not reserve space on the spare for the array. If there is sufficient free space on the spare, the controller will use that spare during failover. See Chapter 7, *Managing Spares*.

To change the spare disk drives while making other array changes:

1 From the Reconfigure Array dialog box, select the disk drives you want to add or remove as spares.

– To add spare drives, select one or more drives in the Available Drives list and click **Add Spare**. The disk drives you selected move to the Selected Drives list and display a spare icon and yellow asterisk showing that they are new spares for this array. See *Understanding the Selected Disk Drive Icons* on page 2-9.

– To remove spare disk drives, select one or more spares in the Selected Drives list and click **Remove**.

- To select more than one disk drive, hold the **Ctrl** key and click each drive.

2 Complete your other array changes.

3 Click **Reconfigure**.

Storage Manager Pro reconfigures the array using your changes.You can continue using the array while Storage Manager Pro reconfigures it even though the reconfiguration may take several hours to complete, depending on the array type, size of the array, and the I/O load. See *Viewing Task Progress* on page 6-4.

Deleting an Array

Caution: Deleting an array permanently deletes all partitions and data from the array, including the file system and drive letter. The data cannot be recovered, even by a data recovery service.

When you delete an array, the space on the disk drives that were part of the array revert to free space, allowing you to use the space for another array.

To delete an array:

1 In the System Browser window, select the array you want to delete.

2 Click **Delete**.

Storage Manager Pro confirms that you want to permanently delete the selected array.

3 Click **Yes**.

Storage Manager Pro deletes the array.

Note: If you delete a RAID 1 array, you must click **Rescan** after the array has been deleted to display the correct number of disk drives in the Arrays Panel.

Viewing Array Properties

You can view the array properties by opening the Properties dialog box. It contains information about the array including array name, type, and capacity.

To view the array properties:

1 In the System Browser window, select the array you want to view.

2 Click **Properties**.

The Array Properties dialog box appears.

For more information about each of the properties tabs, refer to the Online Help.

4

Managing Controllers on Remote Systems

In This Chapter

You can access and manage controllers on remote systems connected to your network. The systems you can manage on the network must have:

- Storage Manager Pro–compatible controllers

- Storage Manager Pro installed and running

This allows you to configure arrays on the remote systems and use all Storage Manager Pro functions from a single location. You can use a system that does not have a controller, but you do need Storage Manager Pro installed and running on that system to manage other systems on the network.

Once you access a remote system, you remain logged into that system until you end your Storage Manager Pro session.

Understanding Remote Access

You set up access to remote systems by designating one system as the directory manager for Storage Manager Pro. You do this by registering each system with the directory manager. The directory manager is the system that other systems register with and that stores all user accounts for the management set.

Using the diagram below as an example, to set up remote access you would start Storage Manager Pro on systems A, B, and C, and register them with the directory manager (System D). You register with the directory manager by entering the directory manager's system name or IP address in Storage Manager Pro.

All the systems that register with a specific directory manager plus the directory manager itself are collectively called a *management set*.
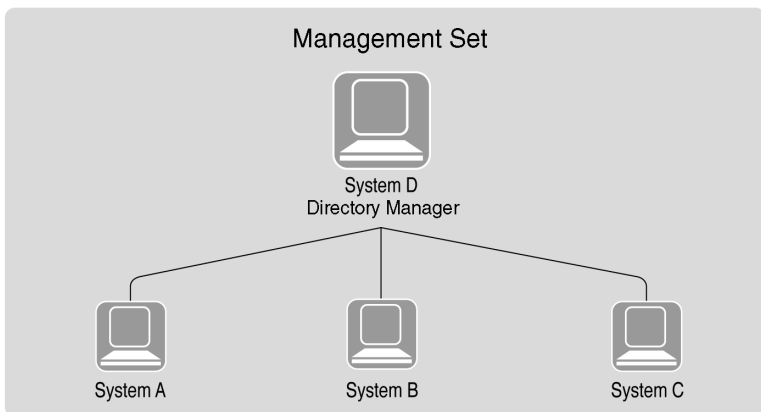
You can set up multiple management sets. Each management set can have only one directory manager and each system can be a member of only one management set.

When you start Storage Manager Pro on any of the systems in this example management set, you will have access to all four systems from the Storage Manager Pro Dashboard. You can then select the system you want and click **Open System**.
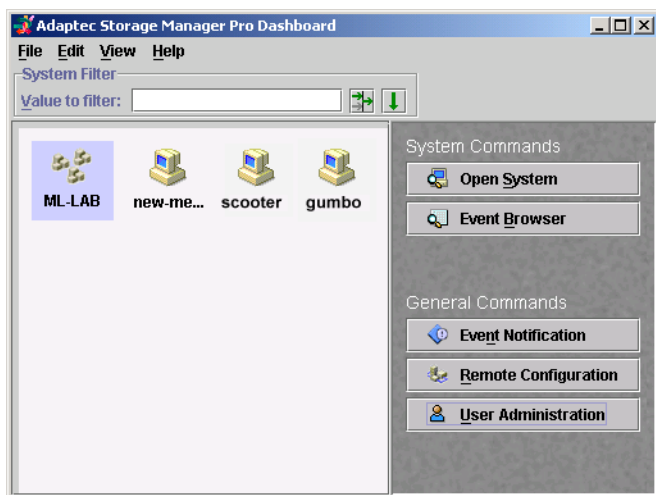
Notice the icon for the ML-LAB system in the figure. This icon indicates that the ML-LAB system is the directory manager.

If a system icon is gray, the system either is not running Storage Manager Pro, is shut down, or is not accessible from your network for another reason.

The Remote Configuration button is not available if you are logged on with a user account that does not have Administration privileges. Restart Storage Manager Pro and log in using an account with Administration privileges.

Note: We strongly recommend that you back up the directory manager system regularly to ensure that your management set configuration and global directory can be restored.

Setting Up Remote Access for the First Time

To set up remote access, you must register each system with the directory manager. See *Setting Up Remote Access from the Directory Manager* on page 4-4.:

Note: All systems must have the same version of Storage Manager Pro installed.

You can set up remote access from either of two systems on your network:

■ System that will become the directory manager

■ System that will become a member of the new management set

Setting Up Remote Access from the Directory Manager

The instructions below assume you are setting up from the directory manager, rather than from a member of the management set.

To set up remote access:

1 Decide which systems you want to be members of the management set (not the directory manager) and start Storage Manager Pro on those systems.

Write down the system name or IP address of each system you want to be in the management set.

The Storage Manager Pro service (ASMProServer) must be running on those systems. After you install Storage Manager Pro, the Storage Manager Pro service (ASMProServer) starts automatically when you boot the system. See *Starting Adaptec Storage Manager Pro* on page 1-3.

2 Start the Storage Manager Pro software on the system that you want to be the directory manager.

See *Starting Adaptec Storage Manager Pro* on page 1-3.

3 From the Storage Manager Pro Dashboard on the system you used in step 2, click **Remote Configuration**.

The Remote Configuration dialog box appears.
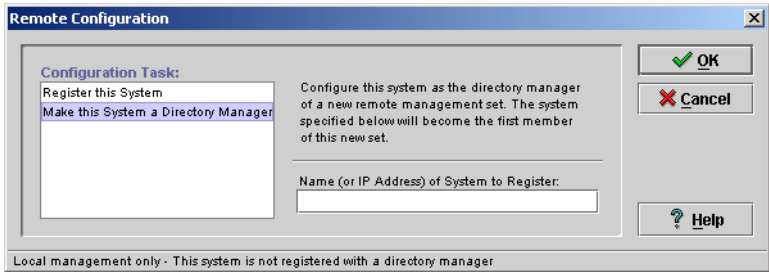
4 From the Configuration Task list, select **Make This System a Directory Manager**.

5 Type the system name or IP address of the first system you want to register.

6 Click **OK.**

The Remote Configuration Permission dialog box appears.

7 Type an Account Name and Password for the system. The password *is* case sensitive.

> **Note:** The account you use must have Administration privileges.

8 Click **Login**.

Storage Manager Pro confirms that the system was successfully registered.

9 Click **OK.**

The Storage Manager Pro Dashboard appears displaying all the systems that are part of the management set.

Once you register one or more systems with the directory manager, you can use Storage Manager Pro to manage remote controllers.

Setting Up Remote Access from a Member of the Management Set

The instructions below assume you are setting up remote access from a member of the management set, rather than from the directory manager.

To set up remote access:

1 Decide which system you want to be the directory manager and start Storage Manager Pro on that system.

Write down the system name or IP address of the system you want to be the directory manager.

The Storage Manager Pro service (ASMProServer) as well as the Storage Manager Pro software must be running on the system. After you install Storage Manager Pro, the Storage Manager Pro service (ASMProServer) starts automatically when you boot the system. See *Starting Adaptec Storage Manager Pro* on page 1-3.

2 Start the Storage Manager Pro software on another system that is *not* the directory manager.

See *Starting Adaptec Storage Manager Pro* on page 1-3.

3 From the Storage Manager Pro Dashboard on the system you used in step 2, click **Remote Configuration**.

The Remote Configuration dialog box appears.
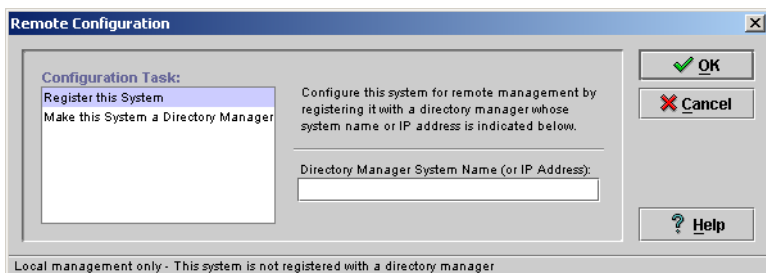
4 From the Configuration Task list, select **Register This System**.

5 Type the system name or IP address of the system you want to be the directory manager.

6 Click **OK.**

The Remote Configuration Permission dialog box appears.

7 Type an Account Name and Password for the directory manager computer. The password *is* case sensitive.

> **Note:** The account you use must have Administration privileges.

8 Click **Login**.

Storage Manager Pro confirms that the system was successfully registered.

9 Click **OK.**

The Storage Manager Pro Dashboard appears displaying all the systems that are part of the management set.

Once you register one or more systems with the directory manager, you can use Storage Manager Pro to manage remote controllers.

Adding a System to an Existing Management Set

You can add a system to an existing management set from any of three systems on your network:

■ System you want to add to a management set

■ Directory manager for the management set

■ Member of a management set, but not the directory manager

The system you are adding must be a stand-alone system—that is, it must not already be a member of a management set.

Storage Manager Pro will ask for authentication when you try to add another system to the management set. If you are on a system that is a member of a management set and want to add a stand-alone system to that management set, you must type a user name and password for an account on the stand-alone system that has Administration privileges. If you are on a stand-alone system and wish to add it to a management set, you must type a user name and password for an account that resides on the directory manager of that management set and has Administration privileges.

To add a system to an existing management set:

1 From the Dashboard, click **Remote Configuration**.

> **Note:** This button is only available if you are logged in under an account with Administration privileges.

The Remote Configuration dialog box appears.

2 Select the Configuration Task based on the system you are working from.

From this system	Select
System you want to add to a management set	Register This System
Directory manager	Add a System to This Set
Member of a management set, but not the directory manager	Add a System to This Set

3 Type the system name or IP address based on the system you are working from.

From this system	Type system name or IP address of
System you want to add to a management set	Directory manager
Directory manager	System you want to add
Member of a management set, but not the directory manager	System you want to add

4 Click **OK**.

5 Type an appropriate login name and password of an account with Administration privileges based on the system you are working from.

If You Are Working on a System That	Use Account with Administration Privileges Residing On The
You want to add to a management set	Directory Manager
Is the Directory Manager	System you want to add to the management set
Is a member of a management set, but not the Directory Manager	System you want to add to the management set

Accessing Remote Systems

Once you register one or more systems with the directory manager, you can use Storage Manager Pro to manage controllers remotely.

Storage Manager Pro will ask for a user account when you try to open another system. In the dialog box, you must type a valid account name and password for an account on the system you are accessing. The process gives you access to remote systems that are part of the management set for the rest of your Storage Manager Pro session.

To access remote systems:

1 From the Dashboard, select the system you want to access.

2 Click **Open System**.

3 Type a valid account login name and password that resides on the remote system you wish to access and click **OK**.

You can now perform all Storage Manager Pro functions on the system you opened.

Checking Which System Is the Directory Manager

If you are not certain which system is the directory manager, you can check from any system that is part of the management set.

From the Storage Manager Pro Dashboard on any system in the set do one of the following:

- From the Normal view, look for the icon that looks like three systems. That is the directory manager. (See page 1-13.)

- From the Detail view, look for a check mark in the Directory Manager column.

Moving a System from One Management Set to Another

You can move a system from one management set to another. You must do this from the system that you want to move.

To move a system from one management set to another:

1 From the Storage Manager Pro Dashboard on the system you want to move, click **Remote Configuration**.

The Remote Configuration dialog box appears.

2 From the Configuration Task list, select **Register with Another Directory Manager**.

3 Type the system name or IP address of the directory manager you want to register with.

4 Click **OK.**

Storage Manager Pro unregisters the system from the old directory manager and registers it with the new one.

If the old directory manager is not available, Storage Manager Pro displays a message letting you know that it could not unregister you from the old management set. You should check that the old directory manager is turned on, has the Storage Manager Pro service (ASMProServer) running (see *Starting Adaptec Storage Manager Pro* on page 1-3), and that it is accessible on your network. Then try the above steps again.

5 Type the login name and password for an account that has Administration privileges and resides on the new Directory Manager, and click **Login**.

Moving the Directory Manager to Another System

You can move the directory manager to another system. You may want to do this when you need to take the system that is currently the directory manager out of service. You can only move a directory manager to a system that is not currently a member of a management set, including a directory manager.

To move a directory manager:

1 From the Storage Manager Pro Dashboard, click **Remote Configuration**.

The Remote Configuration dialog box appears.

2 From the Configuration Task list, select **Move the Directory Manager**.

3 Type the system name or IP address of the system you want to become the new directory manager for the set.

4 Click **OK.**

5 Type the login name and password for an account that has Administration privileges and resides on the new Directory Manager, and click **Login**.

Removing a System from a Management Set

You can remove a system from a management set. After you remove a system from a management set:

■ You can only use Storage Manager Pro locally to manage controllers attached to that system.

■ You *cannot* use Storage Manager Pro

– to access that system from other systems in the set.

– from that system to access other systems in the set.

You can remove a system from a management set from any of three systems on your network:

■ Directory manager

■ Member you want to remove from the management set

■ Member of the management set, but *not* the system you want to remove from the same set

To remove a system from a management set:

1 From the Storage Manager Pro Dashboard, click **Remote Configuration**.

The Remote Configuration dialog box appears.

2 Select the Configuration Task based on the system you are working from.

From this system	Select
Directory manager	Remove a System from This Set
Member you want to remove from the management set	Remove This System from the Set
Member of the management set, but *not* the system you want to remove from the same set	Remove a System from This Set

3 From the drop-down list box, select the System Name or IP Address based on the status of the system you are working from.

From this system	Type
Directory manager	System name or IP address of the system you want to remove from the set
Member you want to remove from the management set	Nothing
Member of a management set, but *not* the system you want to remove from the same set	System name or IP address of the system you want to remove from the set

4 Click **OK.**

Storage Manager Pro confirms that you want to remove a system from the management set.

5 Click **Yes**.

If the old directory manager is not available, Storage Manager Pro displays a message letting you know that it could not unregister you from the old management set. You should check

that the old directory manager is turned on, has the Storage Manager Pro service (ASMProServer) running (see *Starting Adaptec Storage Manager Pro* on page 1-3), and that it is accessible on your network. Then try the above steps again.

5

Managing Storage Manager Pro Users

In This Chapter

Understanding User Accounts

You can create Storage Manager Pro user accounts so that others can manage controllers. Accounts control access to the systems they reside on. You must use an account that resides on a remote system to manage controllers and browse the event log on that remote system. For convenience, you may create accounts on remote systems. See *Creating Accounts on Remote Systems* on page 5-4.

You can apply Administration privileges to user accounts. Administration privileges allow you to add or remove remote systems to a management set, or create and edit user accounts.

Storage Manager Pro comes with one default administrator account. When you first install Storage Manger Pro, you are prompted to provide a new password.

Adding User Accounts

> **Note:** Login names are *not* case sensitive; however, passwords *are* case sensitive.

You can add user accounts as long as you have an account with Administration privileges. Administration privileges allow you to add or remove remote systems to a management set, or create and edit user accounts.

To add a user account:

1 From the Storage Manager Pro Dashboard, select the system you want to add an account to and click **User Administration**.

If you selected a remote system, the Remote Access Permission dialog box appears. Type an Account Name and Password that has Administration privileges on the remote system and click **Login**.

The User Administration dialog box appears.
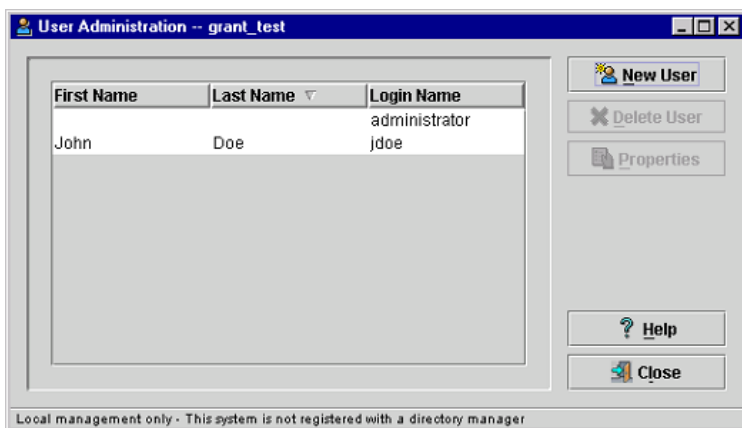
2 Click **New User**.

The New User dialog box appears.

3 Type the following information into each field:

Field	Description
Login Name	ID the user types when logging in to Storage Manager Pro. Login names are *not* case sensitive.
Password	Password for this user account. You cannot use spaces. Passwords *are* case sensitive and are limited to eight characters.
Verify Password	Confirmation of the password. Must match the previous field exactly.
First Name	User's first name.
Last Name	User's last name.

4 If this account needs to be able to create or edit user accounts, or add other systems to a management set, select the **Administration** check box.

5 Click **OK**.

Storage Manager Pro lists the new account in the User Administration dialog box. You can change user account information, except for the login name, at any time. See *Changing User Accounts* on page 5-5.

6 Click **Close** to close the User Administration dialog box.

Creating Accounts on Remote Systems

For convenience, you can create user accounts on remote systems.

To create a user account on a remote system:

1 From the Storage Manager Pro Dashboard, select the system you want to add an account to, and click **User Administration**.

2 The User Administration dialog box appears.

If you have not previously accessed that remote system, you will be asked to type a user name and password for an account on that system.

> **Note:** The account you use must have Administration privileges. If you use an account *without* Administration privileges, exit Storage Manager Pro, restart it, and log in again using an account with Administration privileges.

3 Click **New User**.

The New User dialog box appears.

4 Type the following information into each field:

Field	Description
Login Name	ID the user types when logging in to Storage Manager Pro. Login names are *not* case sensitive.
Password	Password for this user account. You cannot use spaces. Passwords *are* case sensitive and are limited to eight characters.
Verify Password	Confirmation of the password. Must match the previous field exactly.
First Name	User's first name.
Last Name	User's last name.

5 If this account needs to be able to create or edit user accounts, or add other systems to a management set, select the **Administration** check box.

6 Click **OK**.

Storage Manager Pro lists the new account in the User Administration dialog box. You can change user account information, except for the login name, at any time.

7 Click **Close** to close the User Administration dialog box.

Changing User Accounts

You can change user accounts as long as you have an account with Administration privileges. Administration privileges allow you to add or remove remote systems to a management set, or create and edit user accounts.

To change a user account:

1 From the Storage Manager Pro Dashboard, click **User Administration**.

The User Administration dialog box appears.

2 Select the account you want to change.

3 Click **Properties**.

The User Properties dialog box appears.

4 Change the information in any of the following fields.

Field	Description
Login Name	You cannot change the login name. If you want to change the login name, you must create a new account and delete the old one.
Password	• Password for this user account. You cannot use spaces. Passwords *are* case sensitive and are limited to eight characters. • Current password is displayed as 16 asterisks (*), regardless of the actual length of the password. As soon as you type one character in the field, Storage Manager Pro erases the old password and you must type a new one.
Verify Password	• Confirmation of the password. Must match the previous field exactly. • Current password is displayed as 16 asterisks (*), regardless of the actual length of the password. As soon as you type one character in the field, Storage Manager Pro erases the old password and you must type a new one.
First Name	User's first name.
Last Name	User's last name.

5 If this account needs to be able to create or edit user accounts, or add other systems to a management set, select the **Administration** check box.

6 Click **OK**.

Storage Manager Pro changes the account information.

7 Click **Close** to close the User Administration dialog box.

Deleting User Accounts

You can delete user accounts only if you have an account with Administration privileges. Administration privileges allow you to add or remove remote systems to a management set, or create and edit user accounts.

To delete a user account:

1 From the Storage Manager Pro Dashboard, click **User Administration**.

The User Administration dialog box appears.

2 Select the account you want to delete.

3 Click **Delete User**.

The system will prompt you to confirm the deletion.

4 Select **Yes**.

Storage Manager Pro deletes the account.

5 Click **Close** to close the User Administration dialog box.

Changing Your Password

You can change the password for your user account.

To change your password:

1 From the Storage Manager Pro Dashboard, click **User Administration**.

The User Administration dialog box appears.

2 Select the account you used to log in to Storage Manager Pro.

3 Click **Properties**.

The User Properties dialog box appears.

4 Change the password fields.

Field	Description
Password	• Password for this user account. You cannot use spaces. Passwords *are* case sensitive and are limited to eight characters. • Current password is displayed as 16 asterisks (*), regardless of the actual length of the password. As soon as you type one character in the field, Storage Manager Pro erases the old password and you must type a new one.
Verify Password	• Confirmation of the password. Must match the previous field exactly. • Current password is displayed as 16 asterisks (*), regardless of the actual length of the password. As soon as you type one character in the field, Storage Manager Pro erases the old password and you must type a new one.

5 Click **OK**.

Use your new password the next time you log in.

6 Click **Close** to close the User Administration dialog box.

6

Monitoring System Status

In This Chapter

Monitoring Events

Storage Manager Pro generates events to inform you of changes to your array configuration, errors, failovers, and other functions. You should regularly check events to see if anything has happened to any of the devices or arrays that may require your attention.

Events are logged in a file that you can view two ways:

■ Event Browser—allows you to view events. See *Viewing Events* on page 6-2.

■ *EventLogs.txt*—text file that lists events. Use this file if you cannot use Storage Manager Pro to run the Event Browser. The file is in your *data* directory under the directory where you installed Storage Manager Pro.

Viewing Events

The Event Browser lets you view and filter events.

The log file has a maximum size of 15 MB, or approximately 50,000 events. When the file reaches the size limit, Storage Manager Pro removes the first 33 percent of the events (oldest events) from the file and uses that space to write new events.

To view events:

■ From the Storage Manager Pro Dashboard, click **Event Browser**.

The Event Browser window appears and displays all events. Refer to the Online Help for event definitions.

You can filter events by the time and date the event occurred. See *Using the Time and Date Filter* on page 6-3.
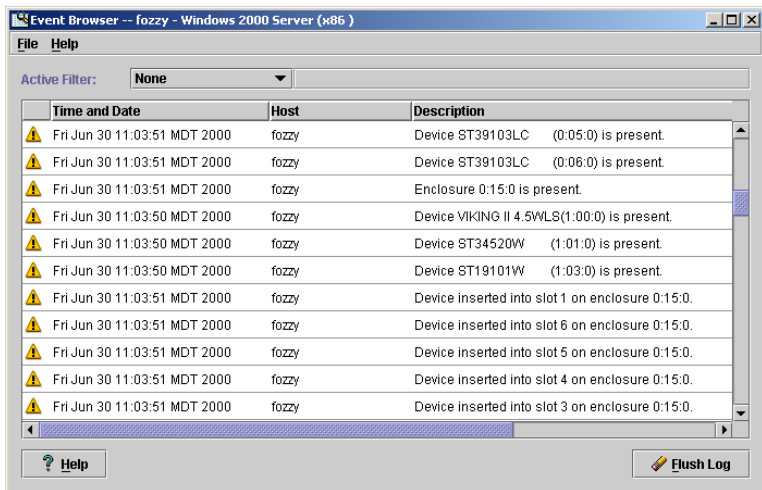
Using the System Filter

If the system you are using is part of a management set, you can filter the events that are displayed. You can see the events on all systems that are part of the set or events on just one system.

To view events from all systems in the management set, select **None** from the Active Filter drop-down list box.

To filter by system:

1 From the Event Browser window, select **System** from the Active Filter drop-down list box.

The System Filter dialog box appears.
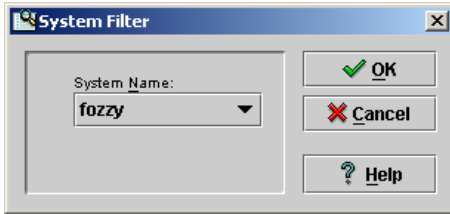
2 From the System Name drop-down list box, select the name of the system whose events you want to view.

3 Click **OK**.

The Event Browser displays events related to the system whose name you selected.
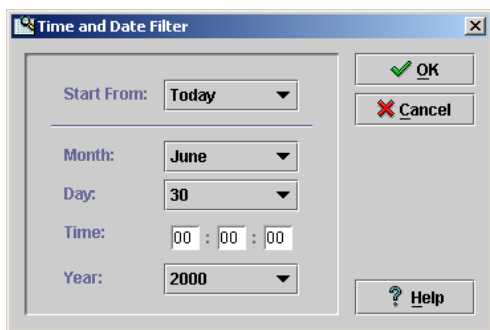
Using the Time and Date Filter

You can filter events in the Event Browser window by the time and date the event occurred.

To view all events, select **None** from the Active Filter drop-down list box.

To filter by time and date:

1 From the Event Browser window, select **Time and Date** from the Active Filter drop-down list box.

The Time and Date Filter dialog box appears.

2 From the Start From drop-down list box, select an option:

– **Today**—Displays all events that occurred today.

– **Yesterday**—Displays all events that occurred since yesterday.

– **Other**—Allows you to select a specific date and time from the lower part of the window. From the drop-down list boxes, select a Month, Day, and Year, and type a Time. You cannot use a future date or time.

3 Click **OK**.

The window changes to display only the events that occurred since the time and date you selected.

Deleting Events

To permanently delete all events in the log:

■ Click **Flush Log** in the Event Browser window.

Caution: This permanently removes all event data from the Storage Manager Pro log file.

Only user accounts with Administration privileges can flush the log. See *Understanding User Accounts* on page 5-1.

Viewing Task Progress

When Storage Manager Pro starts a task such as creating an array, reconstructing an array, or zeroing a disk drive, Storage Manager

Pro displays a small progress bar next to the affected device or array in the System Browser window. While the task is running, you can:

■ See more detailed task progress. Follow the steps described in this section.

■ Terminate the task. See *Terminating a Task* on page 6-6.

Some tasks take only a few seconds or less to complete. These tasks do not last long enough to show task progress.

To see detailed task progress:

1 In the System Browser window, select the array, disk drive, or other device that is affected by the task.

2 In the Details pane, click the **Tasks** tab.

The Tasks tab shows detailed information about any task that is running that affects the selected device or array. The Caution icon may show that a task is running on the selected array or device, or that the array or device may not be ready for use.

When a task is running, some functions may not be available for the selected array or device. The buttons for unavailable functions are gray.
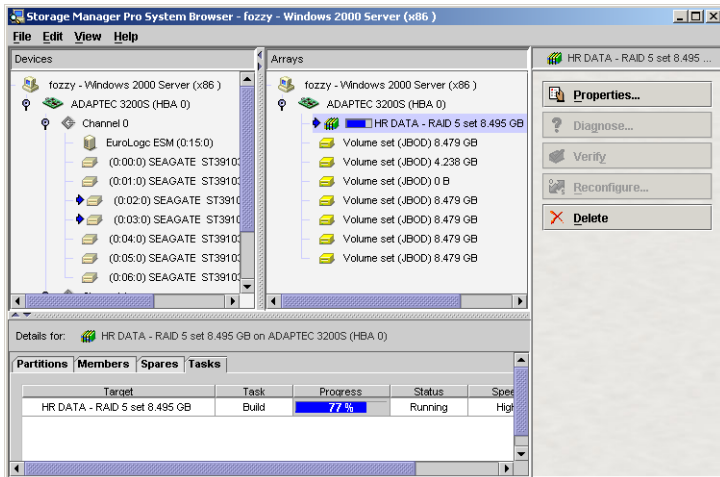
After the task is complete, its information disappears from the Tasks tab. See *Understanding the Details Pane Status Column* on page 6-7.

> ✔ **Note:** When you create a redundant array (mirror set [RAID 1], RAID 3 set, RAID 4 set, RAID 5 set, stripe set of mirror sets [RAID 0/1], or stripe set of RAID 5 sets [RAID 0/5]), Storage Manager Pro performs a Build task after it creates the array. The progress of the Build task appears in the Task tab.

Terminating a Task

You can terminate some tasks in Storage Manager Pro at any time. Some tasks take only a few seconds or less to complete and do not last long enough to permit termination.

If you terminate the Build task, the array exists but may not be usable. To make the array usable, you need to delete the array and re-create it.

> ⚠ **Caution:** You risk losing data if you terminate a Build task.

To terminate a task:

1 In the System Browser window, select the array, disk drive, or other device that is affected by the task.

2 In the Details pane, click the **Tasks** tab.

3 Select the task that you want to terminate.

4 Click **Terminate**.

The task stops running.

Understanding the Details Pane Status Column

The Status column for each device in the Details pane may display an indicator that changes based on the condition of the device:

■ None—Device is working.

■ Information ⓘ—Shows that Storage Manager Pro has some information to report.

■ Caution ⚠—Warns you about a potential problem with the device.

■ Critical ✖—Warns you that the device has failed.

Information, Caution, and Critical icons similar to those above are displayed next to any device or array in the Devices or Arrays pane when something has happened to the device or array.

For more information about what to do when you see the status indicators, see *Using the Diagnose Button* on page 11-2.

Setting Up Event Notification

Event Notification is a function of Storage Manager Pro that, once set up, can inform you about events of a specified severity that may occur on your DuraStor external RAID controller.

Event Notification allows you to designate multiple recipients to receive an e-mail or an e-mail pager message when an event, such as failover, occurs.

You can specify a minimum event severity level, such as informational, warning, or critical, for the events for which you want to receive notification. You can assign different severity levels for each recipient as well as which severity levels trigger each notification type (e-mail or e-mail pager). For example, you can assign User A to receive both e-mail and e-mail pager messages about all events with a severity of warning or greater while User B is notified only by e-mail pager and only about all critical events.

Event Notification can be set up for either a single system or for all systems that are members of a management set.

## Defining and Modifying Notification E-mail Settings

The Event Notification E-mail Settings allow you to customize your event messages, including the ability to specify your SMTP server as well as the e-mail addresses to display in the From and To fields of the event e-mails sent to your recipients. Before you can add notification recipients, you must first define the Event Notification E-mail Settings.

To define or modify the Event Notification E-mail Settings:

1 From the Dashboard, click **Event Notification**.

If you have not already defined the e-mail settings, the E-mail Settings dialog box appears.

If you have defined the e-mail settings previously, the Event Notification dialog box appears. To change the e-mail settings, click **E-mail Settings**.
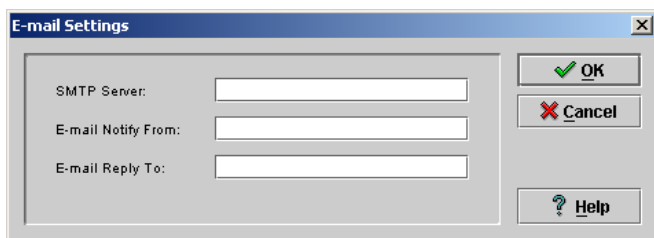
2 In the E-mail Settings dialog box, type the following information and click **OK**:

– SMTP Server—This is the name of the server used for your mail service.

– E-mail Notify From—This is the e-mail address the recipient sees in the notification e-mail. This helps users manage their e-mail correspondence. For example, this allows them to sort these incoming notification e-mail messages into a separate folder.

– E-mail Reply To—This is typically set by the system administrator, but can be any e-mail address you want to use.

Adding Notification Recipients

To add recipients for Event Notification:

1 From the Dashboard, click **Event Notification**.

The Event Notification dialog box appears.

> **Note:** If this is the first time you are setting up Event Notification, you need to first define your Event Notification E-mail Settings. See *Setting Up Event Notification* on page 6-7.

2 Click **New**.

The New Recipient dialog box appears.

3 Type the name of recipient in the Recipient Name field. This is the name that appears in the list of recipients.

4 Select the type of notification you want the recipient to receive (you can select one or both types):

– **E-mail**—The recipient will receive an e-mail when the specified events occur.

– **E-mail Pager**—The recipient will receive an e-mail page when the specified events occur.

5 For each notification type assigned to the recipient, type the recipient's e-mail address.

You may want to send a test e-mail notification to confirm that the address is correct. See *Sending a Test E-mail Notification* on page 6-12.

6 From the drop-down list box, select the Minimum Event Severity that will generate an e-mail or e-mail page to the recipient.

You can assign different minimum event severities for each notification type (e-mail and e-mail pager):

– **Informational**—The recipient will receive notification about all Informational, Warning, and Critical events. Informational events indicate changes to the system that do not affect performance, such as when an array has been created or when a system goes online.

– **Warning**—The recipient will receive notification about all Warning and Critical events. Warning events indicate changes that may adversely impact the system, such as when an enclosure reaches the specified temperature limit or a Verify process is incomplete.

– **Critical**—The recipient will receive notification about Critical events only. Critical events indicate changes that do impact the system, such as a failover or when a drive goes bad.

7 Click **OK**.

Storage Manager Pro will notify the recipient the next time the specified event type (Informational, Warning, or Critical) occurs.

Changing Recipient Properties

Recipient properties include the assigned notification type (e-mail or e-mail pager), e-mail address, and assigned severity level for each recipient. You can also use the Recipient Properties dialog box to turn notification off for a recipient but maintain a record of the recipient's name and e-mail address. This is useful for temporarily turning off notification for a recipient who will be out of the office for a few weeks.

To permanently remove a recipient from Event Notification, see *Deleting Notification Recipients* on page 6-12.

To change the notification properties for an existing recipient:

1 From the Dashboard, click **Event Notification**.

The Event Notification dialog box appears.

2 From the list of recipients, select the name of the person whose properties you want to change.

3 Click **Properties**.

The Recipient Properties dialog box appears. You can make changes to all of the fields in the Recipient Properties dialog box except the Recipient Name. If you want to change the name, first delete the recipient and then add a new notification recipient using the new name.

4 Select the type of notification you want the recipient to receive (you can select one or both types):

– **E-mail**—The recipient will receive an e-mail when the specified events occur.

– **E-mail Pager**—The recipient will receive an e-mail page when the specified events occur.

5 For each notification type assigned to the recipient, type the recipient's e-mail address.

You may want to send a test e-mail notification to confirm that the address is correct. See *Sending a Test E-mail Notification* on page 6-12.

6 From the drop-down list box, select the Minimum Event Severity that will generate an e-mail or e-mail pager message to the recipient.

You can assign different minimum event severities for each notification type (e-mail and/or e-mail pager):

– **Informational**—The recipient will receive notification about all Informational, Warning, and Critical events. Informational events indicate changes to the system that do not affect performance such as when an array has been created or when a system goes online.

– **Warning**—The recipient will receive notification about all Warning and Critical events. Warning events indicate changes that may adversely impact the system, such as when an

enclosure reaches the specified temperature limit or a Verify process is incomplete.

– **Critical**—The recipient will receive notification about Critical events only. Critical events indicate changes that do impact the system, such as a failover or when a drive goes bad.

7 Click **OK**.

Storage Manager Pro will use the new information in the recipient's properties to notify the recipient the next time the specified event severity (Informational, Warning, or Critical) occurs.

Deleting Notification Recipients

To delete a recipient from Event Notification:

1 From the Dashboard, click **Event Notification**.

The Event Notification dialog box appears.

2 Select the name of the person you want to remove from the list of Recipients.

3 Click **Delete**.

The recipient's name is removed from the list and will no longer receive Event Notification e-mails or pages.

Sending a Test E-mail Notification

Once you set up Event Notification, you may want to send a test e-mail to be sure the recipient's e-mail address is valid and working properly.

To send a test e-mail:

1 From the Dashboard, click **Event Notification**.

The Event Notification dialog box appears.

2 From the list of Recipients, select the name of the person to whom you want to send a test e-mail.

3 Click **Test E-mail**.

The Send a Test E-mail dialog box appears.

4 In the Send To field, select one of the following:

- – **E-mail Address**—to send an e-mail to the recipient
- – **E-mail Pager Address**—to send an e-mail pager message to the recipient

5 In the Text field, type the message you want to appear in the body of the e-mail.

You may want to write a message asking the recipient to respond to the e-mail to confirm delivery of the message.

6 Click **Send**.

Storage Manager Pro sends an Event Notification e-mail or e-mail pager message to the recipient.

7

Managing Spares

In This Chapter

Understanding How Spares and Failover Work

Storage Manager Pro allows you to assign spare disk drives either to a specific array or to a spare pool. If the controller detects an unrecoverable error during I/O, it checks for an available spare drive that has sufficient free space to handle the failover. *Failover* is the process by which the controller rebuilds data on a spare drive when a drive that is part of an array fails.

Note: Spares only work with redundant array types: mirror set (RAID 1), RAID 3 set, RAID 4, set RAID 5 set, stripe set of mirror sets (RAID 0/1), or stripe set of RAID 5 sets (RAID 0/5).

The free space on the spare must be contiguous and must be equal to or larger than the used space (space allocated to an array) for one array on the failed disk drive.

If a disk drive in a redundant array fails, the controller checks for spares in the following order until a suitable spare is found:

1 Spares assigned to a specific array.

2 If the array is a multilevel array (such as RAID 0/1, RAID 0/5), spares assigned to the parent of a specific array.

3 Disk drives assigned to the spare pool. The disk drives in the spare pool are checked in the order in which they were assigned as spares.

4 If the Dynamic Spares option is enabled, any available disk drive.

You can assign spares in one of two ways:

■ To a specific array. See *Managing Spares Assigned to an Array* on page 7-2.

■ To the spare pool. See *Managing the Spare Pool* on page 7-4.

You can also use all available disk drives. See *Enabling Dynamic Spares* on page 7-6.

See *Spare Management Guidelines* on page 7-8 for important information and suggestions.

Managing Spares Assigned to an Array

You can assign spare disk drives to any redundant array (mirror set [RAID 1], RAID 3 set, RAID 4 set, RAID 5 set, stripe set of mirror sets [RAID 0/1], or stripe set of RAID 5 sets [RAID 0/5]). This gives you more control over what the controller does if a disk drive fails. The controller checks spares assigned to a specific array first. See *Understanding How Spares and Failover Work* on page 7-1.

There are two parts to managing spares assigned to an array:

■ Adding a spare to an array. See page 7-2.

■ Removing a spare from an array. See page 7-4.

Adding a Spare to an Array

You can add a spare to a specific array in one of three ways:

■ While creating a new array. See *Creating a Custom Array* on page 2-5.

■ While reconfiguring other settings of an existing array. See *Changing Dedicated Spare Disk Drives* on page 3-7.

■ Using the Manage Spares function for an existing array, as described in this section.

To add a spare using Manage Spares for an existing array:

1 In the System Browser window, select the array to which you want to add a spare.

2 Click **Manage Spares**.

The Manage Spares dialog box appears.
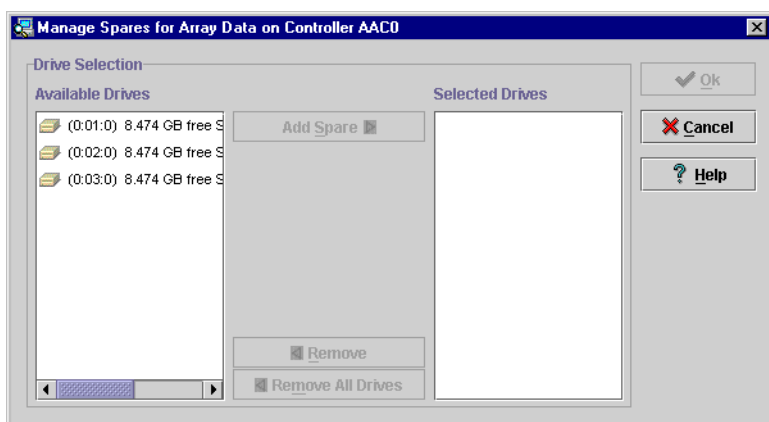
The Available Drives list shows all disk drives that have sufficient free space for the current array and the Selected Drives list shows all spares currently assigned as spares to the array.

Disk drives that are assigned to the current array are not displayed in the Available Drives list.

3 Select the disk drive you want as a spare from the Available Drives list.

– To select more than one disk drive, press and hold the **Ctrl** key and click each disk drive.

4 Click **Add Spare**.

The selected disk drive moves to the Selected Drives list and its icon changes to a spare icon. This disk drive retains the spare

icon everywhere in the System Browser window, as long as it is
still assigned as a spare to any array. See *Understanding the
Selected Disk Drive Icons* on page 2-9.

5 Click **OK**.

Removing a Spare from an Array

You can remove a spare from a specific array in one of two ways:

■ While reconfiguring other settings of an existing array. See
Changing Dedicated Spare Disk Drives on page 3-7.

■ Using the Manage Spares function for an existing array, as
described in this section.

To remove spares using Manage Spares for an existing array:

1 In the System Browser window, select the array from which you
want to remove a spare.

2 Click **Manage Spares**.

The Manage Spares dialog box appears. The Selected Drives list
shows the disk drives that are assigned as spares to the current
array.

3 Select the disk drive you want to remove as a spare from the
Selected Drives list:

– To select more than one disk drive, press and hold the **Ctrl**
key and click each disk drive.

– To remove all spares from the current array, click **Remove All
Drives**.

4 Click **Remove**.

The selected disk drive moves to the Available Drives list. See
Understanding the Selected Disk Drive Icons on page 2-9.

5 Click **OK**.

Managing the Spare Pool

You can assign spare disk drives to the spare pool. If a disk drive
failure occurs, the controller checks the spare pool for a spare drive
with sufficient space for one or more of the failing disk drives.

Because of the total flexibility you have in managing spares, you must monitor your spares regularly to ensure that you have the level of spare security that you need. See *Spare Management Guidelines* on page 7-8 for suggestions.

There are two tasks involved in managing the spare pool:

■ Adding a disk drive to the spare pool. See page 7-5.

■ Removing a disk drive from the spare pool. See page 7-6.

Adding a Disk Drive to the Spare Pool

Note: When adding disk drives to the spare pool, select the drives with the highest SCSI ID numbers to avoid potential SCSI ID conflicts with redirected disk drives.

To add a disk drive to the spare pool:

1 In the System Browser window, select the controller or storage system to which you want to add a spare.

2 Click **Manage Spare Pool**.

The Manage Spare Pool dialog box appears. The Available Drives list shows all disk drives attached to the controller that have free space. The Selected Drives list shows all disk drives currently assigned to the spare pool on the controller.
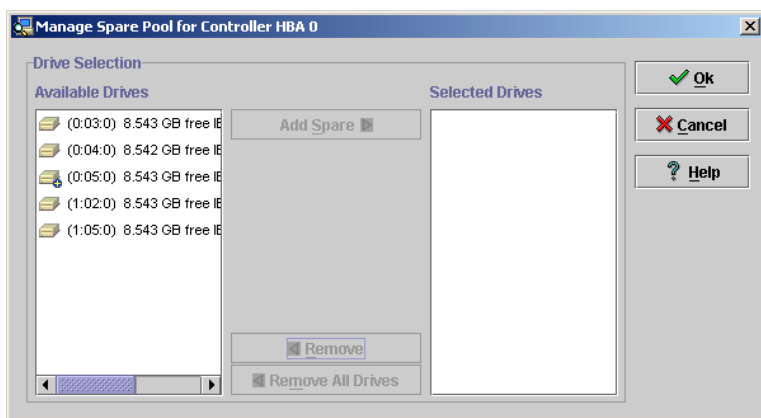
3 Select the disk drives you want to add from the Available Drives list. To select more than one disk drive, press and hold the **Ctrl** key and click each disk drive.

4 Click **Add Spare.**

The disk drives you just added appear in the Selected Drives list and will be used in the event of a disk drive failure.

5 Click **OK**.

Removing a Disk Drive from the Spare Pool

You can remove a disk drive from the spare pool at any time.

To remove a disk drive from the spare pool:

1 In the System Browser window, select the controller or storage system from which you want to remove a spare.

2 Click **Manage Spare Pool**.

The Manage Spare Pool dialog box appears. The Selected Drives list shows all disk drives currently assigned to the spare pool.

3 Select the disk drives you want to remove from the Selected Drives list:

– To select more than one disk drive, press and hold the **Ctrl** key and click each drive.

– To remove all disk drives from the spare pool, click **Remove All Drives**.

4 Click **Remove.**

The disk drives are removed from the Selected Drives list and now appear in the Available Drives list.

5 Click **OK**.

Enabling Dynamic Spares

The Dynamic Spares option lets you hot swap a failed disk drive. For example, if you enable dynamic spares and a disk drive fails, you can replace (*hot swap*) the failed disk drive and the controller automatically uses the new drive as a spare.

> **Note:** The Dynamic Spares option is only available for redundant array types: mirror set (RAID 1), RAID 3 set, RAID 4 set, RAID 5 set, stripe set of mirror sets (RAID 0/1), or stripe set of RAID 5 sets (RAID 0/5).

To enable dynamic spares:

1 In the System Browser window, select the controller where you want to enable the Dynamic Spares option.

2 Click **Properties**.

The Controller Properties dialog box appears.

3 Click the **Options** tab.

4 Select the **Enable Dynamic Spares** option.

> **Note:** Make sure that the new or available disk drive is large enough to replace the smallest disk drive in the array and does not contain metadata.

Viewing Spare Assignments and Status

You should regularly check your spare assignments and the status of each spare disk drive. You can check spare assignments by viewing the details for the following:

■ Controller—Shows spare pool disk drives.

■ Disk drive—Shows that the disk drive is assigned to a specific array.

■ Array—shows which disk drives are assigned to the array as dedicated spares.

To check disk drives in the spare pool via the controller:

1 In the System Browser window, select the controller for which you want to check spares.

2 In the Details pane, click the **Spares** tab.

The Spares tab shows which disk drives are assigned as spares to the spare pool.

To check disk drives assigned to a spare pool or assigned as dedicated spares:

1 In the System Browser window, select the disk drive whose spare status and assignment you want to check.

2 In the Details pane, click the **Spares For** tab.

The Spares For tab shows whether this disk drive is assigned to an array as a spare, to an array as a dedicated spare, or to a controller as part of the spare pool.

To check spares assigned to an array by array:

1 In the System Browser window, select an array for which you want to check spares.

2 In the Details pane, click the **Spares** tab.

The Spares tab shows which drives are assigned as spares for this array.

Spare Management Guidelines

How you manage your spares is a trade-off between the level of security your applications require and the cost of spare disk drives.

Disk drives do not fail very often, but when they do, the result may be catastrophic for your business. You must determine your needs and manage your spares accordingly.

Consider the following as you manage your spares:

■ General

– Using spares does *not* replace the need for regular backups of your data.

– You *cannot* assign spares to nonredundant arrays (stripe set [RAID 0] and volume set). Consider using these array types only for noncritical data that does not change often and that can be easily restored from backups.

■ Assigning spares to an array

– Try to select spare disk drives that are on different channels from the current disk drives in the array.

- – Consider assigning a spare to the array that has your most critical data. Then, consider using that disk drive only as a spare, that is, do *not* use it for an array.

- – When you reconfigure an array, determine if you need to change the spare assignments. For example, if you expand the capacity of an array and you have an assigned spare, check that the assigned spare has enough free space for the resized array.

- – Regularly check which disk drives are spares and which arrays they are assigned to. Check that the free space on the spare is sufficient for the array. See *Viewing Spare Assignments and Status* on page 7-7.

- ■ Assigning disk drives to the spare pool

  - – Assign at least one disk drive to the spare pool that has enough free space for the largest array on your system.

  - – Regularly check which disk drives are spares and how much free space they have. Compare their free space to the largest array on your system. See *Viewing Spare Assignments and Status* on page 7-7.

8

Managing Disk Drives and Partitions

In This Chapter

Understanding Disk Drives

Disk drives are the physical devices that store your data. The DuraStor external RAID controller uses SCSI drives.

SCSI disk drives are identified by a disk ID displayed in the following format:

1:02:0

Channel Number   SCSI ID   Logical Unit Number (LUN)
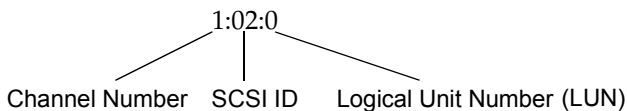
■ Channel Number—Indicates to which channel (bus) on the controller the drive is attached.

■ SCSI ID—Identifies the drive on the SCSI channel.

■ Logical Unit Number (LUN)—The number assigned to a subdevice (logical unit) of a SCSI device, which is usually zero for a disk drive.

Storage Manager Pro displays the disk ID in the System Browser window and in the Disk Properties dialog box.

Replacing Disk Drives

You can replace a failed drive in an array. For detailed instructions, see *Replacing a Failed Disk Drive in an Array* on page 3-1.

> **Caution:** You should not remove a disk drive that is used by an array. This may cause you to lose data.

Blinking a Disk Drive

You can use the Blink function to blink the activity light of a specific disk drive to help you visually identify it.

To blink a drive:

1 In the System Browser window, select the drive you want to blink.

2 Click **Blink**.

Storage Manager Pro confirms that it will blink the disk drive for approximately two minutes. You can stop the blinking by clicking **Unblink** at any time.

Clearing Metadata from a Disk Drive

All of the member disk drives in an array contain metadata in the first sectors of the disk drive. The controller uses the metadata to identify array members after restarting or changing controllers.

You can clear the metadata from a disk drive if you have a drive that was previously a member of an array. Disk drives in this state display a message telling you to clear the metadata. After you clear the metadata, you can use the disk drive in an array or as a spare.

To clear metadata from a disk drive:

1 In the System Browser window, select the disk drive whose metadata you want to clear.

2 Click **Clear Metadata**.

The system clears the metadata from the disk drive.

Viewing Disk Drive Properties

You can view the disk drive properties from the tabs on the Disk Properties dialog box. There are three tabs:

■ Product—Displays manufacturer-specific information about the drive.

■ SCSI—Displays the SCSI address and connection information.

■ Cache— Displays the status of the drive's cache.

To view the disk drive properties:

1 In the System Browser window, select the drive you want to view.

2 Click **Properties**.

The Disk Properties dialog box appears.
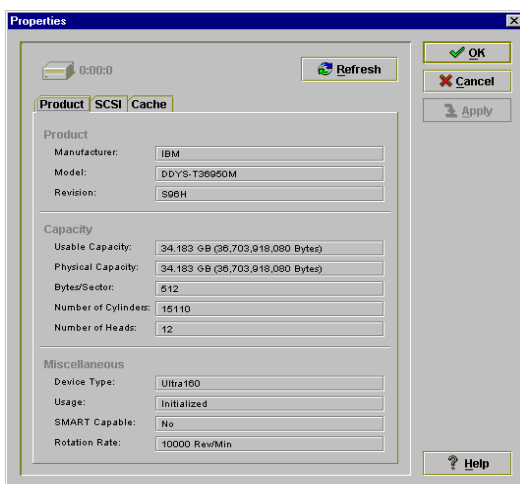
For more information about the properties, refer to the Online Help.

Understanding Partitions

A *partition* is a contiguous area of storage space produced during the RAID creation process. When a controller creates an array, it automatically converts some or all of the free space on a disk drive into one or more partitions. See *Partitions* on page A-4.

These partitions are not seen by the operating system. Rather, they are the building blocks of a virtual disk. This virtual disk is seen by the operating system as a single disk drive.

Viewing Partition Properties

You can view partition properties, which contain information about the partition.

To view the partition properties:

1 In the System Browser window, select the drive whose partition properties you want to view.

2 In the Details pane, select the partition you want.

3 Click **Properties**.

The Partition Properties dialog box appears.

Properties		
☐ 1:04:0	🔄 **Refresh**	✓ **OK**
		✗ **Cancel**
Partition		⬆ Apply
Capacity:	16.921 GB (18,168,348,672 B)	
Partition Offset:	0 Bytes (0 B)	
Device ID:	4:0 (ID:LUN)	
State:	Used by craid4	? **Help**

For more information about the properties, refer to the Online Help.

9
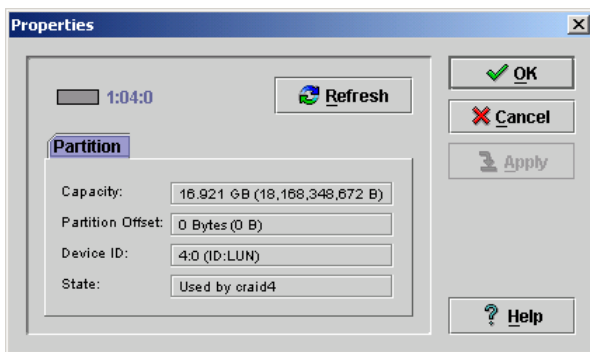
Managing Controllers

In This Chapter

In addition to the tasks listed above, you can use Storage Manager Pro to perform the following functions related to the controller:

■ Create an array. See Chapter 2, *Creating an Array*.

■ Manage spares. See Chapter 7, *Managing Spares*.

■ Manage remote systems. See Chapter 4, *Managing Controllers on Remote Systems*.

Rescanning a Controller

You can rescan the channels of the selected controller to verify the presence of existing devices or to recognize new devices added to a channel.

To rescan for controllers connected to the storage system, see *Rescanning for Controllers* on page 9-15.

To rescan the controller's channels:

1 In the System Browser window, select the controller you want to rescan.

2 Click **Rescan**.

Storage Manager Pro rescans the controller channels and updates the System Browser window with the devices currently attached to the channels.

Shutting Down a Controller

You may need to shut down and restart the controller when any of the following circumstances apply:

■ You need to power it down

■ You need to move it

■ You need to replace it

■ You expect a power outage that lasts longer than the battery life

■ You must shut down the host system for any period of time longer than the battery life

> **Caution:** Anyone accessing an array when you shut down the controller will lose access and may lose data.

We strongly recommend that you use these procedures to shut down the controller gracefully and do not just turn off the power. A normal shutdown ensures that the write-back cache has been flushed to the disk.

To shut down a controller:

1   In the System Browser window, select the controller you want to shut down.

2   Click **Shutdown Controller**.

3   Reboot from the Operator Control Panel of the RAID appliance, or from Adaptec Disk Array Administrator via Hyperterminal.

See *Shutting Down the Other Controller* on page 9-13 and *Shutting Down Both Controllers* on page 9-13 for additional, active-active configuration commands.

Rebooting a Controller

Rebooting a controller shuts it down, then restarts it. You may need to do this after making configuration or hardware changes.

To reboot a controller:

1   In the System Browser window, select the controller you want to reboot.

2   Click **Reboot Controller**.

The system performs its self-test. The controller will disappear from the System Browser window. When it reappears, the reboot is complete.

See *Rebooting the Other Controller* on page 9-14 and *Rebooting Both Controllers* on page 9-14 for additional, active-active configuration commands.

Restoring Controller Defaults

You can restore all of a controller's default settings. You may want to do this if the controller is not working properly and you cannot determine the reason why. You can then change the settings that are critical to your configuration.

To restore the controller default settings:

1   In the System Browser window, select the controller whose defaults you want to restore.

2   Click **Restore Controller Defaults**.

Storage Manager Pro resets all of the controller's settings to the default settings.

Pausing and Resuming I/O

You should pause I/O whenever you need to remove disk drives without powering down the system. Pausing I/O stops the flow of data on all channels of the controller that is selected in the System Browser window. You can resume I/O at any time.

To pause I/O:

1 In the System Browser window, select the controller whose I/O you want to pause.

2 Click **Pause I/O**.

The Pause I/O dialog box appears.

> ⚠️ **Caution:** The controller limits the amount of time that I/O can be paused to avoid application or system time-outs. If you exceed the time limit, you might lose data. Refer to your controller's documentation for the time limit. The Resume I/O button becomes available and Storage Manager Pro displays the Pause I/O message.

3 Click **Yes** in the Pause I/O dialog box.

To resume I/O at any time:

■ Click **Resume I/O**.

Storage Manager Pro resumes I/O and rescans the controller channels.

Viewing Controller Properties

The Controller Properties dialog box contains information about the controller.

There are five tabs of information:

■ Product—Displays manufacturer-specific information about the controller, such as serial number and board version.

■ Battery—Allows you to set and monitor the battery age, and enable/disable the alarm on the battery. See *Monitoring Battery Life* on page 9-6.

■ Cache—Allows you to lock the cache to prevent changes by the host system. See *Locking the Write-Back Cache Setting* on page 3-6.

■ Alarm—Allows you to enable/disable the alarm on the controller. See *Disabling the Controller's Audible Alarm* on page 9-9.

■ Options—Allows you to set dynamic spares (see *Enabling Dynamic Spares* on page 7-6) and synchronize the date and time of the controller with the date and time of the host system (see *Synchronizing Dates and Times* on page 9-10).

To view the controller properties:

1 In the System Browser window, select the controller whose properties you want to view.

2 Click **Properties**.

The Controller Properties dialog box appears.
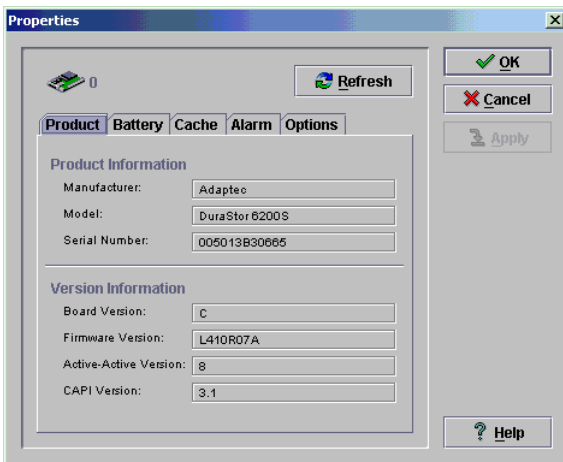
For more information about each of the properties tabs, refer to the Online Help.

Monitoring Battery Life

You can change three settings related to monitoring the life of the battery.

■ You can enable or disable the battery alarm. See page 9-6.

■ You can reset the battery age. See page 9-7.

■ You can enable and disable the battery life monitor. See page 9-8.

Enabling and Disabling the Battery Alarm

If you do not use a battery in your controller, an alarm sounds. To eliminate the alarm, you can set the battery alarm option to Disabled. (The default setting is *Enabled*.)

> ✔ **Note:** You should only disable the battery alarm if you are running the controller with an uninterruptable power supply (UPS), which ensures that you will not lose power to the controller.

If you set the Battery alarm option to Disabled, the controller does not issue warning events or disable the write-back cache.

To enable or disable the battery alarm:

1 In the System Browser window, select the controller whose battery alarm you want to enable or disable.

2 Click **Properties**.

The Controller Properties dialog box appears.

3 Click the **Battery** tab.
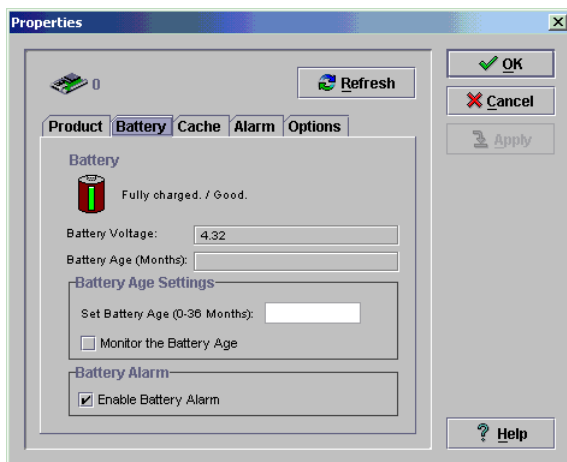
4 Click the **Enable Battery Alarm** check box.

A check mark in the box shows that the battery alarm is enabled. If the box is empty, the battery alarm is disabled.

5 Click **OK**.

You must reboot the controller for the change to take effect.

Resetting the Battery Age

Your controller monitors the life of your battery and creates an event when the battery nears the end of its life. Controller batteries typically last about three years. The event reminding you to replace the battery occurs after approximately 35 months of use. The event appears each time you reboot the controller until you replace the battery and reset the battery age.

When you replace the battery, you must reset the battery age for the battery life monitor to work properly.

You can also change the battery age at any time. You might want to use this option if you install a battery from another controller and want to reset the battery reminder to display at the right time.

To reset the battery age:

1 In the System Browser window, select the controller whose battery you want to enable or disable.

2 Click **Properties**.

The Controller Properties dialog box appears.

3 Click the **Battery** tab.

4 Type the battery age, in months, in the Set Battery Age text box.

5 Click **OK**.

The battery age appears in the Battery Age (Months) box.

You must reboot the controller for the change to take effect.

Disabling and Enabling the Battery Life Monitor

You can disable and enable the battery life monitor. The default setting is *Enabled*.

> ⚠ **Caution:** We *do not* recommend disabling the battery life monitor. Battery failure during normal operation disables write-back cache, and leaves the system exposed to data loss and data corruption in the event of power loss.

To disable or enable the battery life monitor:

1 In the System Browser window, select the controller whose battery you want to enable or disable.

2 Click **Properties**.

The Controller Properties dialog box appears.

3 Click the **Battery** tab.

4 Select the **Monitor the Battery Age** check box.

A check mark in the box shows that the battery age monitor is enabled. If the box is empty, the battery age monitor is disabled.

5 Click **OK**.

You must reboot the controller for the change to take effect.

Disabling the Controller's Audible Alarm

You can disable the controller's alarm.

⚠ **Caution:** We do not recommend disabling the controller's audible alarm. If an alarm condition occurs on the controller, there will be no audible signal to alert you to the problem.

To disable the controller's alarm:

1 In the System Browser window, select the controller whose alarm you want to disable.

2 Click **Properties**.

The Controller Properties dialog box appears.

3 Click the **Alarm** tab.
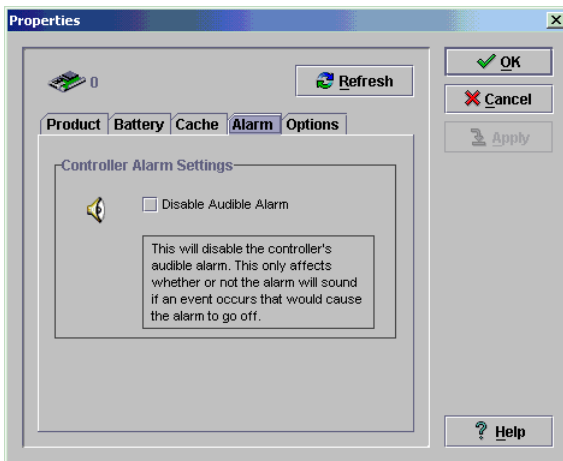
4 Select the **Disable Audible Alarm** check box.

5 Click **OK**.

A check mark appears in the check box.

To re-enable the controller's alarm, deselect the Disable Audible Alarm check box. The check mark disappears.

Locking the Cache Setting

You can prevent host systems from using SCSI mode-select commands to change the controller's write-back cache setting. Some operating systems disable write cache. If cache lock is enabled, the host cannot modify the cache setting. The default setting is disabled.

This option is useful in some environments where the host system disables the controller's write-back cache, resulting in degraded performance.

To lock the cache setting:

1 In the System Browser window, select the controller where you want to lock the cache.

2 Click **Properties**.

The Controller Properties dialog box appears.

3 Click the **Cache** tab.

4 Select the **Lock cache to prevent change by host system** check box.

5 Click **OK**.

Synchronizing Dates and Times

You can synchronize the date and time on the controller with the date and time on the host system.

To synchronize the dates and times:

1 In the System Browser window, select the controller whose date and time you want to synchronize with the host's date and time.

2 Click **Properties**.

The Controller Properties dialog box appears.

3 Click the **Options** tab.
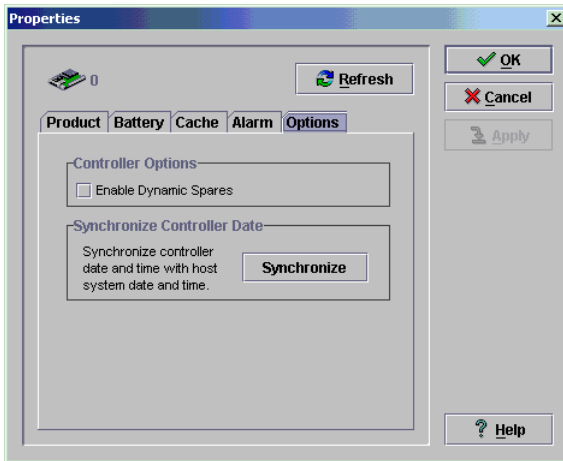
4 Click **Synchronize**.

5 Click **OK**.

Managing Active-Active Controllers

Some Adaptec DuraStor external RAID controllers are configured for active-active mode in which two controllers operate as a pair. If one controller fails, the other can take over the failed controller's work.

In the System Browser window, one controller is identified as controller "0" and the other is designated as controller "1."

> **Caution:** When in active-active mode, the two controllers communicate with each other using SCSI initiator IDs 6 and 7 on the disk channels. The values of 6 and 7 are mandatory defaults to guarantee good communication between the two controllers and you cannot change them. Do *not* configure any other devices to IDs 6 and 7 on the disk channels or the active-active configuration will fail to operate.

The additional controller functions you can perform while in active-active mode include:

- *Changing the Preferred Controller* on page 9-12.

- *Reactivating the Other Controller* on page 9-13.

- *Shutting Down the Other Controller* on page 9-13

- *Shutting Down Both Controllers* on page 9-13

- *Rebooting the Other Controller* on page 9-14

- *Rebooting Both Controllers* on page 9-14

Changing the Preferred Controller

In active-active mode, when two controllers are present on the storage system, arrays can only be accessed by the preferred controller. If the preferred controller fails, the other controller assumes temporary ownership of the array. You can change the preferred controller and thus change ownership of the arrays.

You might want to change the preferred controller if you plan to replace or repair one controller. Changing the preferred controller lets you continue using an array without interruption and makes the array visible on the controller you change to. When you change the preferred controller, you can no longer see the array on the original controller.

Note: When you change the preferred controller, the LUNs assigned to the array become invalid. After changing the preferred controller, you must assign a new LUN to the array. See *Changing the Array LUN* on page 3-6.

To change the preferred controller:

1 In the System Browser window, select the array where you want to change the preferred controller.

2 Click **Properties**.

The Array Properties dialog box appears.

3 Click the **Preferred Controller** tab.

4 From the Set Preferred Controller drop-down list box, select the controller from which you want to access the array.

5 Click **OK**.

Once you have changed the preferred controller, you must assign a new LUN to the array. See *Changing the Array LUN* on page 3-6.

Reactivating the Other Controller

In active-active mode, when there are two controllers on the storage system but one controller is offline, the Reactivate Other Controller option allows you to bring that controller back online.

To reactivate the other controller:

1 In the System Browser window, select the active controller.

2 Click **Reactivate Other Controller**.

Storage Manager Pro brings the other controller back online.

Shutting Down the Other Controller

In active-active mode, when two controllers are present on the storage system, you can gracefully shut down one of the controllers. Use this option in preparation for power down or replacement of the other controller. You should always use the Shutdown Other Controller option in preference to just turning off the power. A normal shutdown ensures that the write-back cache has been flushed to the disk.

To shut down one of the controllers:

1 In the System Browser window, select the controller you do *not* want to shut down.

2 Click **Shutdown Other Controller**.

Storage Manager Pro shuts down the controller that is not selected.

Shutting Down Both Controllers

In active-active mode, when two controllers are present on the storage system, you can simultaneously and gracefully shut down both controllers. Use this option in preparation for a power down of both systems or replacement of both controllers.

To shut down both controllers:

1 In the System Browser window, select one of the controllers you want to shut down.

2 Click **Shutdown Both Controllers**.

Storage Manager Pro shuts down both controllers that are part of the storage system.

Rebooting the Other Controller

In active-active mode, when two controllers are present on the storage system, you can reboot one of the controllers. Rebooting a controller shuts it down, then restarts it. You may need to do this after making configuration or hardware changes to one of the controllers.

To reboot one of the controllers:

1 In the System Browser window, select the controller you do *not* want to reboot.

2 Click **Reboot Other Controller**.

Storage Manager Pro reboots the controller that is not selected.

Rebooting Both Controllers

In active-active mode, when two controllers are present on the storage system, you can reboot both controllers. Rebooting a controller shuts it down, then restarts it. You may need to do this after making configuration or hardware changes to both of the controllers.

To reboot both controllers:

1 In the System Browser window, select one of the controllers you want to reboot.

2 Click **Reboot Both Controllers**.

Storage Manager Pro reboots both controllers that are part of the storage system.

Rescanning for Controllers

You can rescan the storage (host) system to verify the presence of existing controllers. You may want to use the Rescan for Controllers functions if an external RAID controller is grayed out or if you know of a controller that is connected to the storage system but does not appear in the System Browser window.

To rescan for controller's on the storage system:

1 In the System Browser window, select the storage system you want to rescan.

2 Click **Rescan for Controllers**.

Storage Manager Pro rescans the storage system. The rescan process may take a few minutes during which time, the devices in the System Browser window are not displayed. Once the rescan is complete, Storage Manager Pro updates the System Browser window with the controllers currently attached to the storage system.

Viewing Device and Host Channel Properties

You can view the device or host channel properties in the Channel Properties dialog box.

To view the device or host channel properties:

1 In the System Browser window, select the device or host channel whose properties you want to view.

2 Click **Properties**.

The Channel Properties dialog box appears.
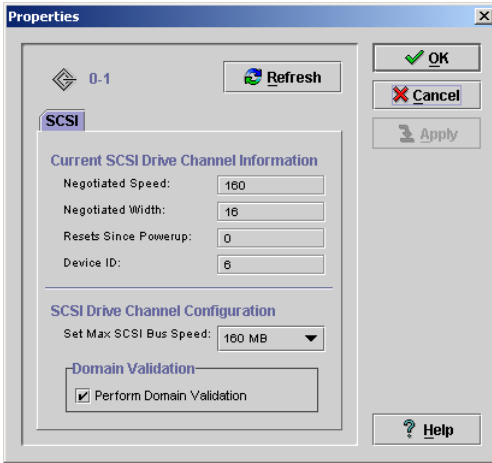
Device Channel Properties
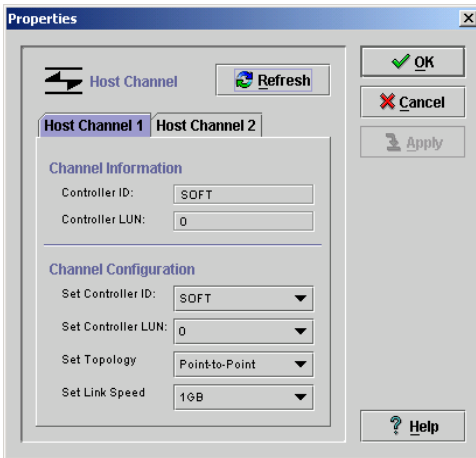
Host Channel Properties

For more information about the device or host channel properties, refer to the Online Help.

10

Managing Storage Enclosures

In This Chapter

For comprehensive information on the features and functions of your DuraStor 312R storage enclosure, refer to the *DuraStor Installation and User's Guide*.

Viewing Storage Enclosure Status

The DuraStor 312R storage enclosures provides information about its components. You can view the available status information in the System Browser window.

To view available storage enclosure status information:

1 In the System Browser window, select the storage enclosure whose status you want to view.

2 Click the tabs in the Details pane of the System Browser window to view the status information.

There are four tabs: Slots, Fans, Power, and Temperature.
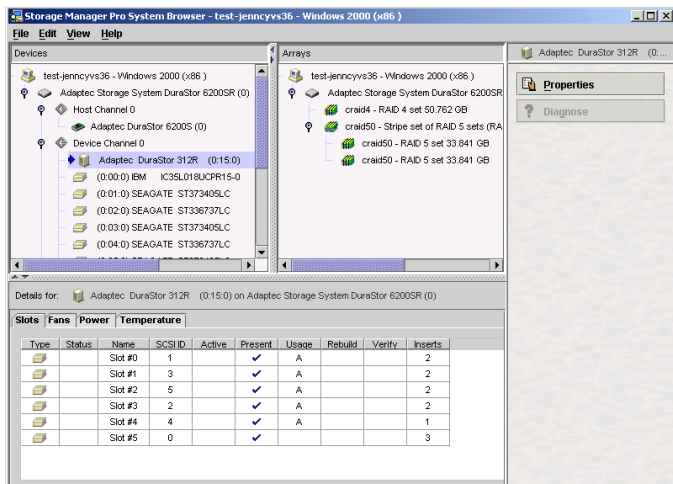
You can view additional information about the storage enclosure in the Enclosure Properties dialog box. See *Viewing Storage Enclosure Properties* on page 10-5.

Turning Off the Audible Alarm

The DuraStor 312R storage enclosure has an audible alarm that sounds when a component failure has occurred, when the temperature limit is exceeded, and when other conditions exist. The storage enclosure has a button that allows you to turn off the alarm. Refer to the *DuraStor Installation and User's Guide* for information about alarm conditions.

You can use Storage Manager Pro to turn off the alarm in the Enclosure Properties dialog box. The Silence button that turns off the alarm is only available when the alarm is sounding.

To turn off the storage enclosure's alarm:

1 In the System Browser window, select the storage enclosure whose alarm you want to turn off.

2 Click **Properties**.

The Enclosure Properties dialog box appears.
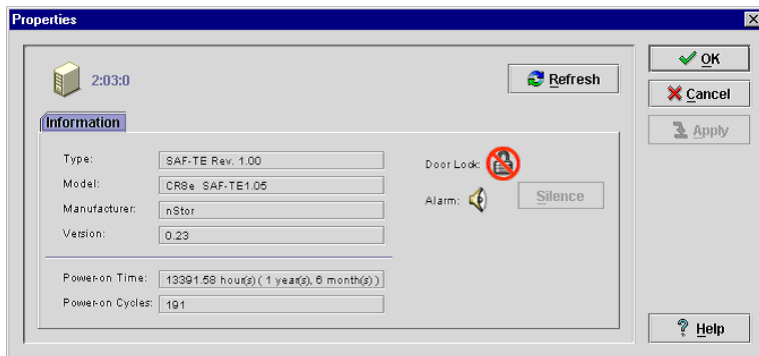
3 Click **Silence**.

4 Click **OK**.

Preparing Slots

Some enclosures, that do not have SAF-TE processors, let you prepare slots for insertion or removal of a disk drive. The Prepare Slots function performs the enclosure-specific operations necessary to prepare the slot for removal or insertion of a device. For example, Prepare Slots may turn off power to the slot. Refer to your enclosure's documentation for more information.

To prepare a slot:

1 In the System Browser window, select the enclosure that has the slot you want to prepare.

2 In the Details pane, click the **Slots** tab.

3 Select a slot you want.

4 Click **Prepare Slots**.

If the disk drive in the slot is part of an array, Storage Manager Pro tells you that the array may become unusable and confirms that you want to prepare the slot.

5 Click **Yes**.

Activating Slots

The Activate Slots function performs the enclosure-specific operations necessary to make the device in the specified slot available on the SCSI channel. The Activate Slots function is only available after Preparing Slots.

To activate a slot:

1 In the System Browser window, select the enclosure that has the slot you want to activate.

2 In the Details pane, click the **Slots** tab.

3 Select the slot you want.

4 Click **Activate Slots**.

Identifying Slots

Some enclosures let you identify slots. Identifying a slot tells the enclosure to show you which slot is selected. Enclosures do this in different ways. For example, the enclosure may flash one or more lights on the slot door. Refer to your enclosure's documentation for more information.

To turn identification on:

1 In the System Browser window, select the enclosure that has the slot you want to identify.

2 In the Details pane, click the **Slots** tab.

3 Select the slot you want to identify.

4 Click **Identify Slot On**. Storage Manager Pro confirms that Identify Slot has been turned on.

5 Click **OK**.

The enclosure identifies the slot.

To turn off identification:

1 In the System Browser window, select the enclosure you want.

2 In the Details pane, click the **Slots** tab.

3 Select the slot you want to identify.

4 Click **Identify Slot Off**.

Storage Manager Pro confirms that Identify Slot has been turned off.

5 Click **OK**.

The enclosure turns off identification.

Viewing Storage Enclosure Properties

The Enclosure Properties dialog box contains information about the enclosure.

To view the storage enclosure's properties:

1 In the System Browser window, select the storage enclosure whose properties you want to view.

2 Click **Properties**.

The Enclosure Properties dialog box appears.

For more information about the properties, refer to the Online Help.

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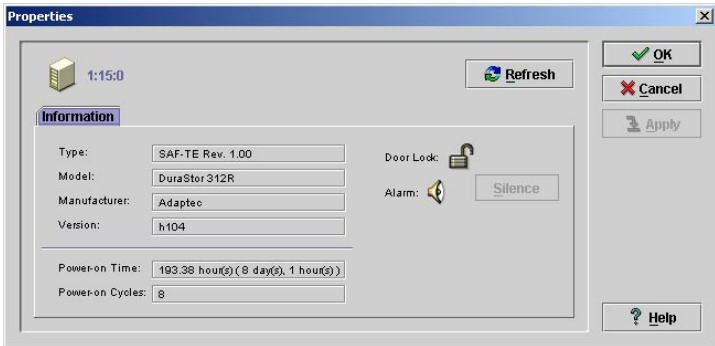
Troubleshooting

In This Chapter

Use the information in the following sections when you have problems using Storage Manager Pro. Check this information before calling for technical support.

Problems Installing and Starting Storage Manager Pro

Problem	Solution
While installing Storage Manager Pro, you receive an error that says that the temporary space required to perform this installation is greater than what is available.	You must have 20 MB of free space for temp files. The installation uses your operating system's temporary free space. Be sure you have that much free space and then restart the installation.
You start the Storage Manager Pro user interface and receive a "cannot connect to local server" error message.	Check that the Storage Manager Pro service is running. If it is not, start it manually. See *Starting Adaptec Storage Manager Pro* on page 1-3.

Resolving Problems Shown by the Status Indicators

The Status column for each device in the System Browser Details pane displays an indicator that changes based on the condition of the device:

■ None—Shows that the system has nothing to report.

■ Information ⓘ—Shows that the system has some information to report.

■ Caution ⚠—Warns you about a potential problem with the device.

■ Critical ❌—Warns you that the device has failed.

Information, Caution, and Critical icons similar to those above are displayed next to any device or array in the Devices or Arrays pane when something has happened to a device or array. You may also see a Diagnose button in the Command Buttons pane. See the next section for information about the Diagnose button.

Using the Diagnose Button

The Diagnose button appears on the System Browser Command Buttons pane and is activated when Storage Manager Pro detects a problem with the selected system, device, or array. Using the Diagnose function, you can see details about the problem including a list of warning and critical events generated from the system where the problem occurred.

For example, if you are creating a RAID 5 set, you will notice a Caution icon ⚠ next to the array immediately after you create the array. If you select the array in the Arrays pane, the Diagnose button is then activated. Clicking the Diagnose button would explain that the array is nonredundant during the verify process. Once the verify process is complete, the array will be redundant, the Caution icon removed, and the Diagnose button will be unavailable.

To use the Diagnose button:

■ Click **Diagnose**.

   The Diagnose dialog box appears listing the description of the problem and the events generated from the system where the problem occurred.

The following are examples of the types of problems that can be displayed in the Diagnose dialog box:

■ Storage enclosure slot problems

■ Storage enclosure fan problems

■ Storage enclosure power supply problems

■ Array redundancy problems

■ Device failure problems

■ Battery problems

Refer to the Online Help for more information about the types of problems.

Managing Controllers on Remote Systems

If you find that you cannot manage controllers on remote systems, use the table below to determine possible solutions.

Problem	Solution
System you want displays a gray system icon in the Dashboard and shows no controllers in the System Browser window.	On the system you want to access remotely, check that the Storage Manager Pro service is running. If it is not, start it. See *Starting Adaptec Storage Manager Pro* on page 1-3.
	If the service is running, check that the system you want to access remotely is accessible on your network.
After trying to move a system to another management set, Storage Manager Pro displays a message that it could not unregister you from the old management set.	This message means that the system you are working from was part of another management set and Storage Manager Pro was not able to unregister the system from that management set. Storage Manager Pro must do this before adding the system to the new management set.
	Check that the directory manager of the original set is turned on, has the Storage Manager Pro service running (see *Starting Adaptec Storage Manager Pro* on page 1-3), and that it is accessible on your network. Then try to add the system again.
User cannot log in.	Check that the directory manager of the management set is turned on, has the Storage Manager Pro service running (see *Starting Adaptec Storage Manager Pro* on page 1-3), and that it is accessible on your network. You can also check to make sure the network card in the system is not configured for TCP/IP stack. Then try again.

A

General Storage Concepts

In This Appendix

Storage Manager Pro uses specific terms to describe storage concepts and configurations. If you are new to storage technology and array configurations, this section will help you understand basic RAID technology and terminology.

This section provides *general* RAID information, not information specifically about the DuraStor storage subsystem.

Devices

A *device* is any type of physical computer storage unit such as a disk drive, controller, or enclosure.

Controllers

A *controller* is a hardware device that performs input/output (I/O) functions. Controllers also perform other functions such as read and write caching and RAID management. They can be internal (inside the host computer) or external (in an enclosure). Controllers are also known as adapters, embedded storage controllers, Host Bus Adapters (HBA), or storage systems.

Storage Systems

A *storage system* exists when the RAID controller resides outside of the server enclosure. The system is controlled from the host system using Storage Manager Pro. Since the controller is located in an external enclosure and accessed using standard SCSI protocols, the need for specific operating system drivers is eliminated. Some external RAID controllers can be configured with single or dual host channels and can support either stand-alone mode or an *active-active* failover pair.

Active-Active Configuration

Active-active configuration refers to a storage system in which two controllers operate as a pair to provide redundancy. If one controller fails, the other controller will take over the failed controller's functionality. To accomplish this, each controller has two host SCSI or FC ports; one which is normally active, the other is normally passive. In a failed-over configuration, the passive port becomes active and assumes the identity of the failed controller. This failover process occurs without user intervention.

In an active-active configuration, arrays can only be accessed by the preferred controller. The other controller does not have visibility to the arrays on the preferred controller. If the controller fails, the surviving controller takes ownership of all arrays. Spares and unassigned disk drives are visible to both controllers.

Stand-Alone Configuration

Stand-alone configuration refers to a storage system in which the controller operates autonomously.

Channels

A *channel* is any path used for the transfer of data and control information between storage devices and a storage controller or storage system. Each controller's channel is identified by a number. A channel is also known as a bus.

Disk Drives

The term *disk drive* refers to the physical devices that store your data.

SCSI drives is identified by a disk ID, which is displayed in the following format:

2:04:0

Channel Number   SCSI ID   Logical Unit Number (LUN)
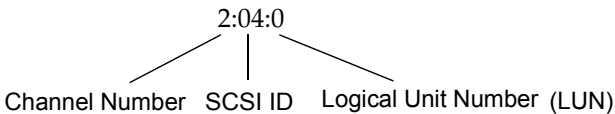
- Channel Number—Indicates to which channel (bus) on the controller the SCSI disk drive is attached.

- SCSI ID (also known as *target ID*)—Identifies the disk drive on the SCSI channel.

- Logical Unit Number (LUN)—The number assigned to a subdevice (logical unit) of a SCSI device, which is usually zero for a disk drive.

Note: If you are using an external controller, the host computer addresses arrays via the controllers' ID and a different LUN for each array.

Free Space

Free space refers to the space on a disk drive that is not in use by an array. Arrays are created from free space, therefore creating an array reduces the amount of free space on a disk drive. When you delete an array, its space is returned to free space.

Partitions

A *partition* is a subdivision of a disk or storage area. There are three main types of partitions:

1 A portion of a physical or virtual disk drive that functions as a separate unit. A single disk drive can be divided into several partitions, each of which the operating system sees as a separate device with its own volume name (such as D:, E:, F:, and so on). These partitions are usually created by the operating system.

2 Contiguous storage space produced during the RAID creation process. When a controller creates an array, it automatically converts some or all of the free space on a disk drive into one or more partitions. See Figure A-1.
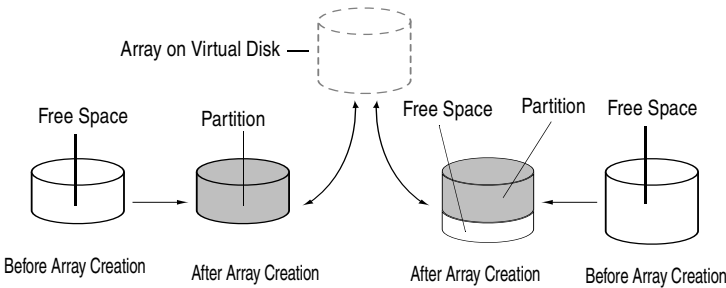
Figure A-1 Array Made of Single Partitions

These partitions are not seen by the operating system. Rather, they are the building blocks of a virtual disk. This virtual disk is seen by the operating system as a single disk drive.

Depending on the type of RAID array created, the virtual disk may be larger than any of its component partitions. For example, a stripe set (RAID 0) created from two partitions presents a virtual disk drive almost two times larger than the individual partitions.

Each of these partitions can be used by only one array at a time.

3 A subdivision of a virtual disk. Some RAID controllers allow you to divide the virtual disk into multiple parts, or partitions. Each partition is seen by the operating system as a separate disk drive.

Redundancy

Redundancy refers to the capability of preventing data loss if a disk drive fails. Some array types give you this capability in one of two methods:

■ Two identical copies—Data is written on two disk drives, resulting in the same data being stored in two places. Mirror sets, for example, use this method.

■ Parity—Error correcting information is distributed across partitions on three or more disk drives. The error correcting information permits the system to rebuild the data if one drive fails. RAID 5 sets, for example, use this method.

Arrays

An *array*, also known as a container, is two or more physical disk drives grouped together to appear as a single device (virtual drive) to the user. Depending on your controller, a volume set created on a single disk drive may also referred to as an array.

An array that spans multiple physical disk drives can be larger than any one of the physical drives. An array's underlying partitions can be smaller than a physical disk drive. Consequently, if the controller allows, several arrays' partitions can reside on a single physical disk drive.

The partitions that make up an array represent *used* (or allocated) space on each disk drive. The used space is available to store data, but cannot be allocated to another array.

Figure A-2 represents an array made up of two disk drives. The free space of the larger drive is not used.
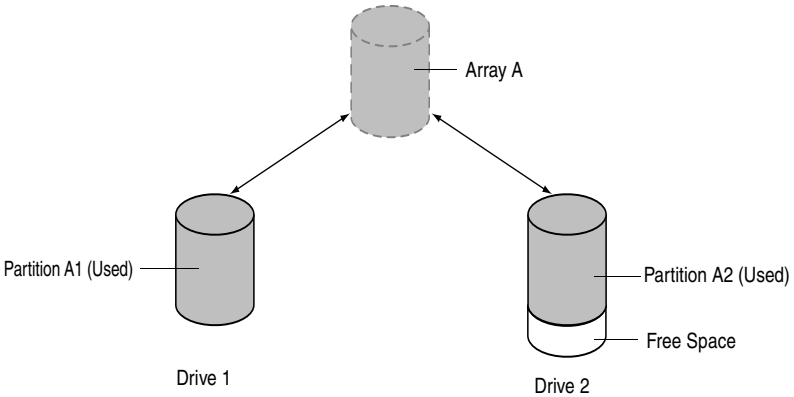
Figure A-2 One array made up of two disk drives

On Windows NT/2000, an array's file system appears in Windows Explorer as a disk drive with its own drive letter.

Array Types

The following are the most common types of arrays. Each is described in more detail in the sections that follow.

Table A-1 Array Types

Array Type	Strengths	Weaknesses
Volume set	■ Low cost.	■ No data protection. ■ Lower performance than RAID sets.
Stripe set (RAID 0)	■ Highest performance. ■ Supports multiple simultaneous read and write operations.	■ No data protection; if one disk drive fails, all data is lost.
Mirror set (RAID 1)	■ Very high data protection. ■ Very high performance for read-intensive applications.	■ High cost for redundancy overhead, because twice the storage capacity is required.
RAID 3 set	■ Very high write performance for applications which must transfer large amounts of sequentially addressed data quickly.	■ Poor transaction (write) performance for small requests since only one request at a time can be executed because the entire array participates in every I/O request.
RAID 4 set	■ Very high read performance (similar to RAID 0) for large files. ■ Large-file write performance can be good as long as applications make large write requests.	■ Transaction (write) performance is significantly lower than single disk drive because of the complexity of parity updates. ■ Parity disk drive can be a bottleneck.

Table A-1 Array Types *(Continued)*

Array Type	Strengths	Weaknesses
RAID 5 set	■ Lower cost than RAID 1. ■ Very high read performance (similar to RAID 0). ■ Very high data protection (similar to RAID 1). ■ Supports multiple simultaneous read and write operations. ■ Can be optimized for large, sequential requests.	■ Write performance is slower than a stripe set (RAID 0) or mirror set (RAID 1).
Stripe set of mirror sets (RAID 0/1)	■ Very high performance. ■ Highest data protection; can tolerate some cases of multiple disk drive failures.	■ High inherent cost, because twice the storage capacity is required. Requires a minimum of four disk drives.
Stripe set of RAID 5 sets (RAID 0/5)	■ Lower cost than RAID 0/1 ■ Higher performance than RAID 5. ■ Very high read performance. ■ Very high data protection. ■ Optimized for multiple simultaneous read and write operations.	■ High inherent cost, because twice the storage capacity is required. Requires a minimum of four disk drives.

The types of arrays you can create depend on the controller you are using. The minimum and maximum number of disk drives you can use for each array type also varies based on the controller.

Volume Set

A *volume set*, also known as a virtual disk or a JBOD, is a single disk drive. Depending on the controller, a volume set can also be a partition that equals the full capacity of a given disk drive. In some controllers, it can be a concatenation of multiple drives.

Volume sets are useful if you have a single disk drive and you do not want to use it as a spare.

Figure A-3 represents a volume set made up of one disk drive.

Volume Set A
4 GB

Partition A
4 GB
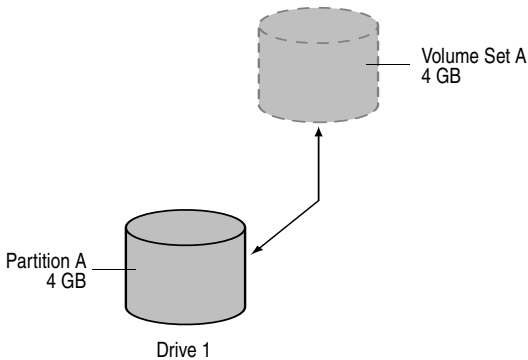
Drive 1

Figure A-3 Volume set

Stripe Set (RAID 0)

A *stripe set* is an array made up of two or more disk drives. The stripe set distributes, or stripes, data evenly across its respective disk drives in equal-sized sections called *chunks*.

Since a stripe set does not protect data against disk drive, channel, or media failure by maintaining redundant data, it is not really a RAID array, but is a good technique for improving I/O performance (compared to that of an equal number of independent disk drives). Because this type of cyclic mapping of stripes of data across an array's member disk drives is commonly used in other RAID arrays, the name RAID 0 is widely used to describe disk striping, even though the method provides no data protection.

A stripe set distributes the data among the partitions in a way that optimizes access speed (high performance). By making a single request for the amount of data in a stripe, an application can get all of the array's member disk drives to work for it simultaneously, thus optimizing the speed of sequential access for large files or concurrent access for multiple small I/O requests. When used with small stripe sizes (compared to average I/O request size), it can improve single-stream data transfer rate. When used with large stripe size (compared to average I/O request size), it can improve I/O request rate.

Figure A-4 depicts a stripe set made up of three partitions on three separate disk drives. The free space of the larger drive is not used.
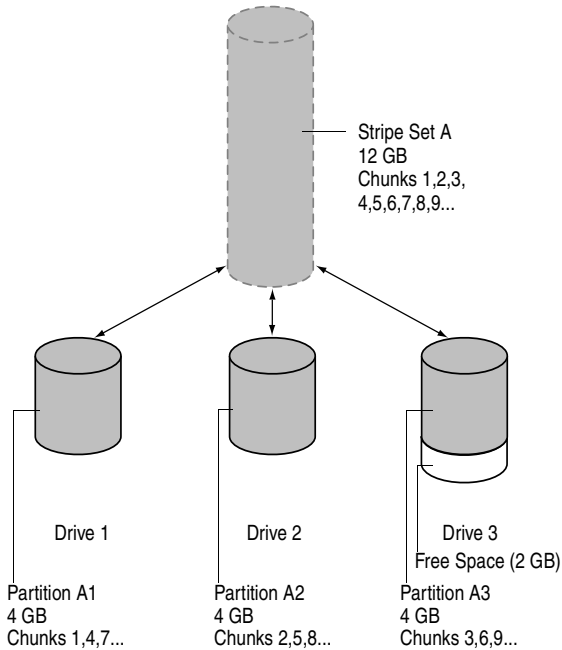
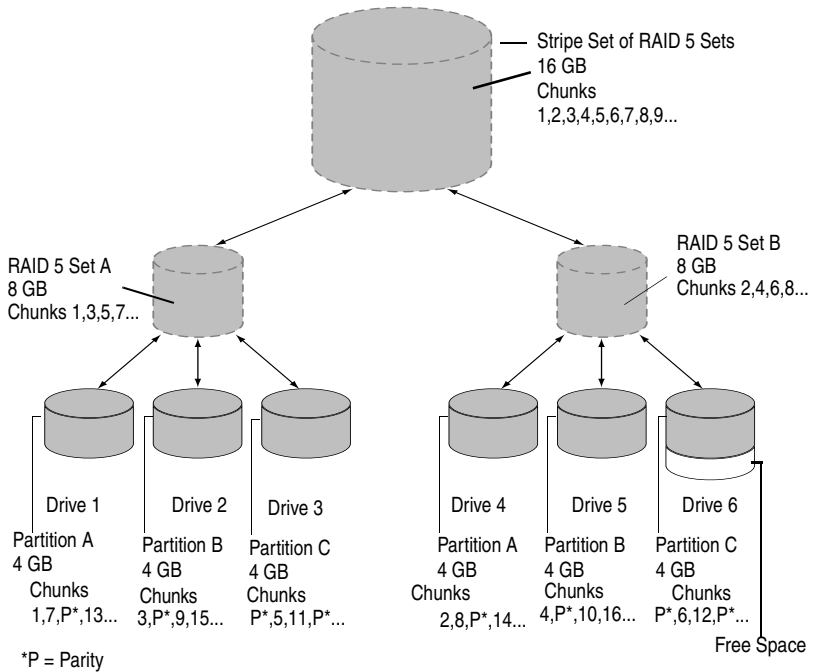Figure A-4 A stripe set made up of three partitions, each on three different disk drives

Applications Suitable for Stripe Sets

Compared to RAID arrays, stripe sets are not well suited for online storage of important data. They can, however, be useful for storing the following:

■ Program image libraries or run-time libraries

■ Large tables or read-only data structures

   The above applications can be backed up on tape or on other RAID arrays for security, while a copy on a stripe array can provide rapid application access.

■ Data collected from external sources at a very high transfer rate

   This is best suited for situations where the data can be restored or is reproducible by repeating the process which produced it.

■ Page files or swap files

Mirror Set (RAID 1)

A *mirror set* is an array made up of two different disk drives. A mirror set stores and maintains the same (redundant) data on each of the two drives. Since a mirror set is an independent-access array, it supports multiple simultaneous read and write operations.

Figure A-5 represents a mirror set. The free space of the larger disk drive is not used.
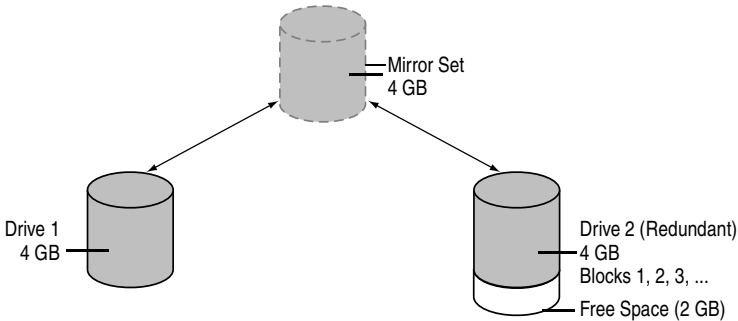
Figure A-5 Mirror set

Applications Suitable for Mirror Sets

Mirror sets are particularly suitable for the following types of applications:

■ Data for which reliability requirements are the first priority

■ Disaster-tolerant systems requiring continuous data access

■ Cloning of online data to obtain a consistent copy of an application's data for backup purposes with minimum application outage

■ Data to which high-performance access is required, and for which cost of storage is secondary

RAID 3 Set

A *RAID 3 set* is an array made up of three or more disk drives. It uses parallel access, meaning that normally all member disk drives participate concurrently in every I/O operation directed at the array. Each virtual disk I/O operation is subdivided and striped or distributed across all data disks; therefore, it uses small stripe depth compared to I/O size. Parity data is stored on a separate parity disk drive.

Parallel-access arrays do not perform well in I/O request–intensive applications. For small requests, the I/O performance is only slightly better than that of a single disk.

RAID 3 set
12 GB
Chunks 1, 2, 3, 4,
5, 6, 7, 8, 9, 10, 11,
12, 13, 14, 15, ...

Free Space

Drive 1
4 GB
Chunks 1, 3, 5, 6,
7, 9, 11, 13, 15, ...

Drive 2
4GB
Chunks 2, 4, 6, 8,
10, 12, 14, ...

Drive 3
4 GB
Parity Drive
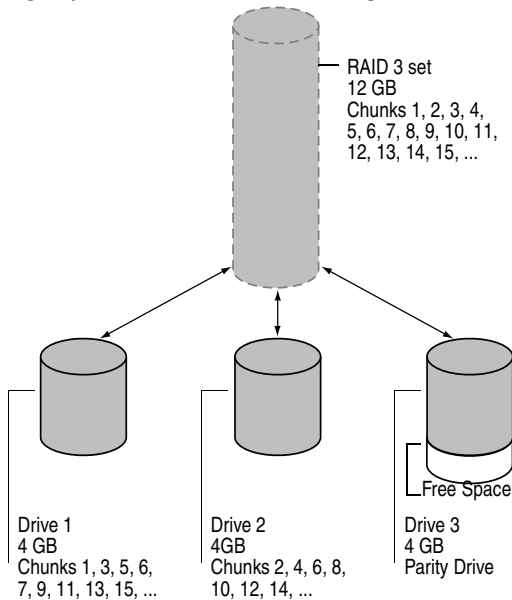
Figure A-6 RAID 3 set

Applications Suitable for RAID 3 Sets

Because RAID 3 sets use small chunks of data, they are particularly suited for the following types of applications:

■ Processors of large data objects, such as audio or video segments, CAD files, graphical images, and seismic or telemetric data streams

■ Noninteractive (batch) applications that process large files sequentially

RAID 4 Set

A *RAID 4 set* is an array made up of three or more disk drives. Data blocks are distributed as with RAID 0 (disk striping). It differs from RAID 3 in two ways: (1) it uses independent access (rather than parallel access), meaning the array's disk drives may operate independently of each other, allowing multiple simultaneous operations, and (2) stripe depth is large compared to I/O size. Parity data is stored on a separate parity disk drive.

RAID 4 Set
12 GB
Chunks 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,12,13, ...

Free Space

Drive 1
4 GB
Chunks 1, 3, 5, 7, 9, 11, 13, ...

Drive 12
4 GB
Chunks 2, 4, 6, 8, 10, 12, ...

Drive 3
4 GB
Parity Drive
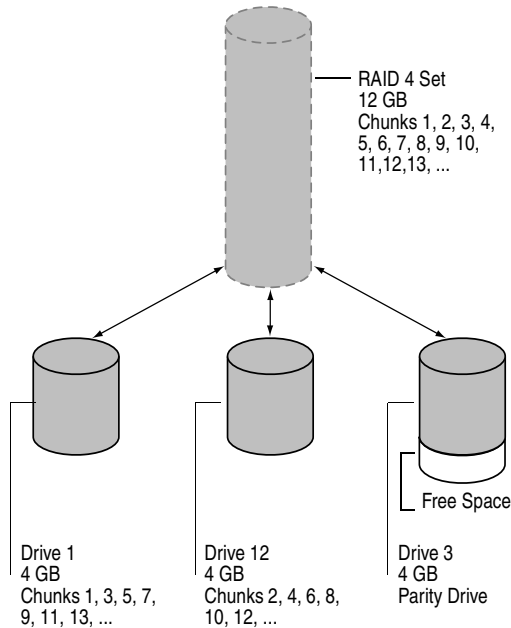
Figure A-7 RAID 4 set

Applications Suitable for RAID 4 Sets

Because RAID 4 sets use larger chunks than RAID 3 sets, they are particularly suitable for the following types of applications:

■ Transaction read requests are high.

■ Data availability is worth protecting, but the cost of mirroring is excessive.

■ There is a small percentage of writes in the I/O load, such as inquiry-type transaction processing, group office automation, and online customer service departments.

RAID 5 Set

The *RAID 5 set* is similar to a RAID 3 set, in that it uses parity to provide redundancy. It differs from a RAID 3 set in that a RAID 5 array's disk drives may operate independently of each other, allowing multiple simultaneous read and write operations. It differs from both RAID 3 and RAID 4 sets in that parity is distributed across all the disk drives in the array rather than residing on a single drive.

A RAID 5 set must be made up of at least three equal-sized partitions on different disk drives to permit the system to rebuild the data if one drive fails. The data is striped evenly across its respective disk drives in equal-sized chunks. You must have at least three partitions.

As data is striped across the partitions, one chunk of each stripe is used for parity data. The parity chunks are distributed across all participating disk drives of the RAID 5 set, so parity operations are evenly divided among all the partitions in the array.

Figure A-8 represents a RAID 5 set made up of four partitions, each on different disk drives. The free space of the larger drive is not used.
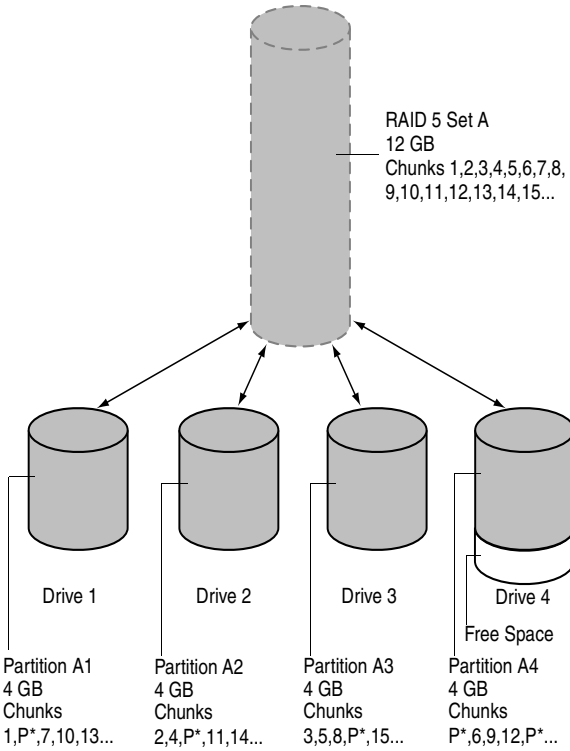
Figure A-8   RAID 5 set

Applications Suitable for RAID 5 Sets

The types of applications suitable for RAID 5 sets are the same as those for RAID 4. The advantage of RAID 5 is the distributed parity, thus eliminating the potential bottleneck of a dedicated parity disk drive.

■ Transaction read requests are high.

■ Data availability is worth protecting, but the cost of mirroring is excessive.

■ There is a small percentage of writes in the I/O load, such as inquiry-type transaction processing, group office automation, and online customer service departments.

Stripe Set of Mirror Sets (RAID 0/1)

RAID technology allows you to create arrays that contain other arrays sometimes known as multilevel arrays or hybrid arrays. A *stripe set of mirror sets*, also known as RAID 0/1 or RAID 10, is an array made up of two or more equal-sized mirror sets. The data in a stripe set of mirror sets is redundant. The mirrored layer of this array enhances data availability by protecting against loss due to member disk drive failure. The striping layer improves performance.

Figure A-9 represents a stripe set of mirror sets created from three equal-sized mirror sets (A, B, and C) and striped across six disk drives. Each mirror set is made up of two partitions on two separate disk drives. The free space of the larger drive is not used.

Stripe Set of Mirror Sets
12 GB
Chunks
1,2,3,4,5,6,7,8,9...

Mirror Set A
4 GB
Chunks 1,4,7...

Mirror Set B
4 GB
Chunks 2,5,8...

Mirror Set C
4 GB
Chunks 3,6,9...

Drive 1   Drive 2   Drive 3   Drive 4   Drive 5   Drive 6
Free Space

Partition A   Partition A(R)*   Partition B   Partition B(R)*   Partition C   Partition C(R)*
4 GB   4 GB   4 GB   4 GB   4 GB   4 GB

*(R) = Redundant
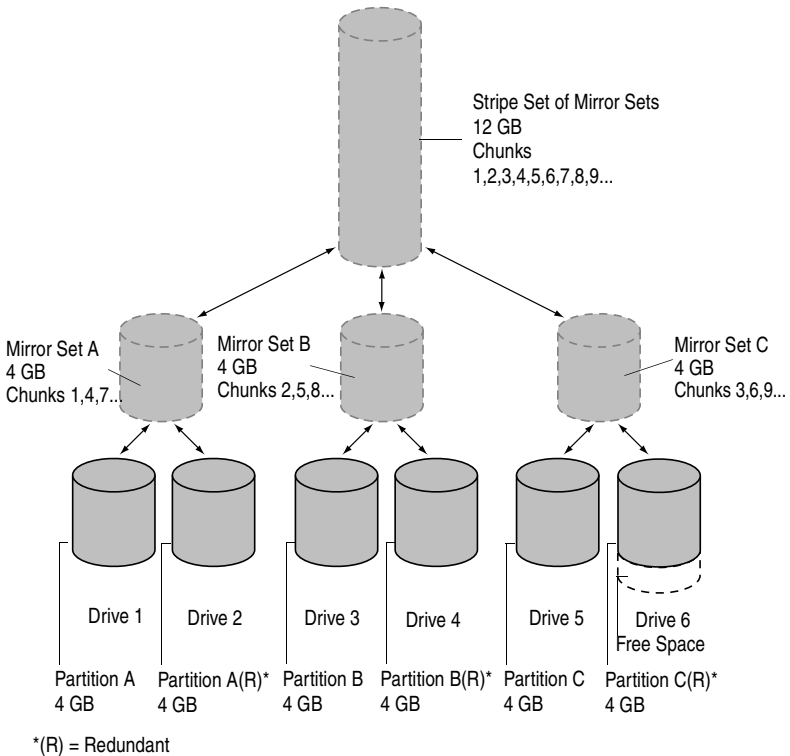
Figure A-9 Stripe set of mirror sets

The stripe set of mirror sets is the top-level array, and mirror sets A, B, and C are the underlying arrays.

Applications Suitable for RAID 0/1 Sets

The following types of applications benefit from the increased data availability and performance provided by RAID 0/1 sets:

■ Any data whose value and volume justifies placing it on mirrored disk storage.

■ Applications with I/O loads consisting predominantly of concurrent read requests, such as transaction processing and database serving applications.

Other types of multilevel arrays exist, though the stripe set of mirror sets offers the best balance of performance and redundancy of all the multilevel array types.

Stripe Set of RAID 5 Sets (RAID 0/5)

RAID technology allows you to create arrays that contain other arrays, sometimes known as multilevel arrays or hybrid arrays. A *stripe set of RAID 5 sets,* also knows as RAID 0/5 or RAID 50, is an array made up of two or more equal-sized RAID 5 sets. The data in a stripe set of RAID 5 sets is redundant. The parity RAID layer (RAID 5) of this array enhances data availability by protecting against loss due to member disk drive failure and its member disk drives provide high data transfer performance. The striping layer improves I/O request handling (compared to that of parity alone).

Figure A-10 represents a stripe set of RAID 5 sets created from two equal-sized RAID 5 sets (A and B) and striped across six disk drives. Each RAID 5 set is made up of three equal-sized partitions on three separate disk drives. The free space of the larger drive is not used.

Stripe Set of RAID 5 Sets
16 GB
Chunks
1,2,3,4,5,6,7,8,9...

RAID 5 Set B
8 GB
Chunks 2,4,6,8...

RAID 5 Set A
8 GB
Chunks 1,3,5,7...

Drive 1

Partition A
4 GB
Chunks
1,7,P*,13...

Drive 2

Partition B
4 GB
Chunks
3,P*,9,15...

Drive 3

Partition C
4 GB
Chunks
P*,5,11,P*...

Drive 4

Partition A
4 GB
Chunks
2,8,P*,14...

Drive 5

Partition B
4 GB
Chunks
4,P*,10,16...

Drive 6

Partition C
4 GB
Chunks
P*,6,12,P*...

Free Space

*P = Parity

Figure A-10 Stripe set of RAID 5 sets

The stripe set of RAID 5 sets is the top-level array, and RAID 5 sets A and B are the underlying arrays.

Note: Stripe size in a stripe set of RAID 5 sets (RAID 0/5) cannot exceed one megabyte. If you select a RAID 0/5 configuration which exceeds the one megabyte limit, Storage Manager Pro prompts you to revise the stripe size of reduce the number of RAID 5 sets.

Note: The configuration of your stripe set of RAID 5 sets (RAID 0/5) is controller dependent. Some controllers require that you have an equal number of disk drives in each of your RAID 5 sets; others allow you to have RAID 5 sets with differing numbers of drives. For example, if you create a RAID 0/5 using seven disk drives, you would have two RAID 5 sets. Some controllers would create the two RAID 5 sets using three disk drives each. In this instance, the seventh drive would not be used. Other controllers would allow you to have two RAID 5 sets, one comprised of three disk drives and the other comprised of four drives.

Applications Suitable for RAID 0/5 Sets

The following types of applications benefit from the improved I/O request handling and high data transfer performance of RAID 0/5 sets:

■ Any application whose data which must be highly available and whose volume, cost restraints, and I/O performance requirements (high data transfer rate) indicate multiple-parity arrays as the basic storage technology.

B

Choosing Your Array Type

In This Appendix

Determining which array type to use depends on the applications running on your server and trade-offs between performance and cost.

Before you choose your array type in Storage Manager Pro, you should evaluate your needs based on the following:

■ Performance—This is based on the requirements of the applications to be run on the system you are setting up. Key performance issues to consider include:

– Fault tolerance—Ability of the system to recover from a failure of one of more drives without interrupting user or application access to data.

– Load balancing—Ability to spread I/O across drives.

– Write performance—Ability to write large amounts of data quickly.

■ Configuration cost—A redundant array offers fault tolerance, but increases your costs.

The following sections explain the differences between the array types to help you determine the best configuration.

If You Are New to Arrays

For those new to arrays, we recommend the following path to help you choose:

1 Read about the array types in *Storage Manager Pro Array Types* on page B-2.

2 Read the examples in *Array Selection Examples* on page B-4.

3 Use the decision chart in *Array Decision Chart* on page B-6 to make your selection.

If You Have Experience with Arrays

For those who have experience with arrays, we recommend the following path to help you choose:

1 Read about the array types available in *Storage Manager Pro Array Types* on page B-2.

2 Read about the selection criteria in *Understanding the Array Selection Criteria* on page B-7.

3 Use the criteria comparison in *Comparing the Selection Criteria* on page B-9 to make your selection.

Storage Manager Pro Array Types

Arrays are logical drives made up of one or more partitions on one or more physical drives.

You can create the following types of arrays using Storage Manager Pro:

■ Volume set—A single drive that is not used in an array. A volume set can also be a partition that equals the full capacity of a given drive.

■ Stripe set (RAID 0)—An array made up of two or more drives. The stripe set distributes, or stripes, data evenly across the partitions in equal-sized sections called *chunks*.

■ Mirror set (RAID 1)—An array made up of two drives. A mirror set stores and maintains the same, or redundant, data in each of its two partitions.

■ RAID 3 set—An array made up of three or more disk drives. It uses parallel access, meaning that normally all member disk drives participate concurrently in every I/O operation directed at the array. Each virtual disk I/O operation is subdivided and striped or distributed across all data disks; therefore, it uses small stripe depth compared to I/O size. Parity data is stored on a separate parity disk drive.

■ RAID 4 set—An array made up of three or more disk drives. Data blocks are distributed as with a stripe set (RAID 0). It differs from RAID 3 in two ways: (1) it uses independent access (rather than parallel access), meaning the arrays' disk drives may operate independently of each other allowing multiple simultaneous operations, and (2) stripe depth is large compared to I/O size. Parity data is stored on a separate parity disk drive.

■ RAID 5 set—An array that is similar to a stripe set, except that it uses parity to provide redundancy. A RAID 5 set must be made up of at least three equal-sized partitions. One chunk is used for parity data for each set of chunks striped across the partitions. The parity chunks are distributed across all drives containing partitions of the RAID 5 set.

■ Stripe set of mirror sets (RAID 0/1)—An array made up of two or more equal-sized mirror sets that also stripes the data across all drives.

■ Stripe set of RAID 5 sets (RAID 0/5)—An array made up of two or more equal-sized RAID 5 sets that also stripes the data across all drives.

For more detailed descriptions of each array type, see Appendix A, *General Storage Concepts*.

Array Selection Examples

The examples in this section show you how to use the array selection criteria to determine the optimum array type for specific server environments. You may find these examples useful in determining the array type that best meets your needs. See *Understanding the Array Selection Criteria* on page B-7.

Generally, most users who require fault tolerance prefer RAID 5 configurations because of the reduced cost of overhead. Users who do not require fault tolerance usually use the stripe set.

Need or System Use	Definition	Suggested Configuration
Mission-critical data	Users must have access to data, and fault tolerance is the highest priority.	■ Stripe set of mirror sets (RAID 0/1) ■ Stripe set of RAID 5 sets (RAID 0/5) ■ Mirror set (RAID 1) ■ RAID 5 set
Application server	Users access applications from the server, but they store their data on their local disk drives; requires high sequential-read performance.	■ Stripe set of mirror sets (RAID 0/1) ■ Mirror set (RAID 1) ■ Stripe set of RAID 5 sets (RAID 0/5) ■ RAID 5 set
Batch applications	Users process large files sequentially.	■ RAID 3 set
Developer environment	Users access data from the server, modify the data, and return it to the server; requires high random-read and -write performance and fault tolerance.	■ Stripe set of RAID 5 sets (RAID 0/5) ■ Mirror set (RAID 1) ■ RAID 5 set
Inquiry processing	Users need redundancy, but rarely need write capability, such as with group office automation and online customer service departments.	■ RAID 5 set

Need or System Use	Definition	Suggested Configuration
Large data objects	Users process large data objects, such as audio or video segments, CAD files, graphical images, and seismic or telemetric data streams.	■ RAID 3 set
Mail server	Users log in to the server to read their mail, and the server transfers the mail files to the user's local disk drive; requires high random-read and -write performance and fault tolerance.	■ Stripe set of RAID 5 sets (RAID 0/5) ■ RAID 5 set ■ Mirror set (RAID 1)
Transaction server	Users at multiple PCs randomly access the server mostly for creating new files and for updating old ones (for example, hospital or banking applications), making data availability critical; requires high random-read performance and fault tolerance.	■ Stripe set of mirror sets (RAID 0/1) ■ Stripe set of RAID 5 sets (RAID 0/5) ■ *Alternate configuration:* Stripe set (RAID 0) to store and manage data; mirror set (RAID 1) to maintain a transaction log file
Video server	Users transfer large blocks of sequential data from the server, edit the data, and return the data to the server; requires high sequential-read and -write performance.	■ Stripe set (RAID 0) ■ RAID 3 set ■ Stripe set of RAID 5 sets (RAID 0/5) ■ RAID 5 set (if fault tolerance is required)
Web server	Users log in to the server to locate and view information. Sometimes they enter data such as registration information or transfer data if an FTP site allows it.	■ Stripe set (RAID 0) ■ RAID 5 set ■ Stripe set of mirror sets (RAID 0/1)

Array Decision Chart

Use the chart below, which spans two pages, to narrow your array choices. Determine which criteria are most important to you and read across the chart to find the best array type to use. For definitions of the criteria, see *Understanding the Array Selection Criteria* on page B-7.

1 Decide which criterion is most important.
2 Select the next most important criterion.
3 Select the next most important criterion.
4 Select one of these array types.

Write Performance
- Fault Tolerance
  - Load Balancing → RAID 0/1
  - Cost of Usable Array Capacity → RAID 1 / RAID 3 (better for large sequential write operations)
- Load Balancing
  - Fault Tolerance → RAID 0/1 / RAID 3 (better for large sequential write operations)
  - Cost of Usable Array Capacity → Striped Set (RAID 0)
- Cost of Usable Array Capacity
  - Fault Tolerance → RAID 0/5 / RAID 3 (better for large sequential write operations)
  - Load Balancing → Striped Set (RAID 0)

Cost of Usable Array Capacity
- Fault Tolerance
  - Load Balancing → RAID 5
  - Write Performance → RAID 3 (better for large sequential write operations) / RAID 0/5
- Load Balancing
  - Fault Tolerance → RAID 0/5
  - Write Performance → Striped Set (RAID 0)
- Write Performance
  - Fault Tolerance → RAID 0/5 / RAID 3 (better for large sequential write operations)
  - Load Balancing → Striped Set (RAID 0)

Understanding the Array Selection Criteria

To help you choose an array type, use the criteria in the following table. Decide how important each criterion is to meeting your data management and storage needs.

Criteria	Definition	Examples
Random-read performance	Ability to locate and read data directly from a file without having to search sequentially from the beginning of the file. Also, multiple-user processes accessing many files concurrently.	Databases, transaction processing programs, and operating system page file

Criteria	Definition	Examples
Random-write performance	Ability to write data directly to a file without having to search sequentially from the beginning of the file. Also, multiple-user processes accessing many files concurrently.	Databases, transaction processing programs, and operating system page file
Sequential-read performance	Ability to read large numbers of consecutive data elements.	Streaming video programs and backup/restore programs
Sequential-write performance	Ability to write large numbers of consecutive data elements.	Streaming video programs and backup/restore programs
Fault tolerance	Ability to recover from a failure of one or more drives without interrupting user or application access to data.	Whenever the user is willing to pay extra to ensure data availability
Expansion	Ability of the system to increase the available storage capacity for the operating system's file system.	Most systems require expansion capabilities to meet growing data storage needs.
Load balancing	Ability to spread I/O across drives.	All I/O-intensive applications benefit from load balancing.
Cost per usable unit of space	Ability to use all space in an array to store user data. (Unusable space includes parity in a RAID 5 set or the redundant half of a mirror set.)	N/A

Comparing the Selection Criteria

The table below rates how well each array type achieves each of the selection criteria. The table uses a scale of 1 to 5: 1 = least effective; 5 = most effective.

Use the table below to compare the array types according to the criteria you rated in the previous section. For example, if random-write performance and load balancing are your most important criteria, then choose a stripe set array type.

Criteria	**Array Type**							
	Volume Set	**Stripe Set (RAID 0)**	**Mirror Set (RAID 1)**	**RAID 3**	**RAID 4**	**RAID 5 Set**	**Stripe Set of Mirror Sets (RAID 0/1)**	**Stripe Set of RAID 5 Sets (RAID 0/5)**
Random-read performance	1	4	3	2	4	4	4	5
Random-write performance	4	5	4	2	1	1	5	3
Sequential-read performance	1	3	2	5	3	3	4	4
Sequential-write performance	3	5	4	4	1	1	4	2
Load balancing	2	4	2	1	3	3	3	5
Cost per usable array space	5	5	1	4	4	4	1	3
Fault tolerance	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Expansion	Yes*	Yes	Yes*	Yes	Yes	Yes	No	No

Glossary

A

array
Two or more physical disk drives grouped together to appear as a single device (logical drive) to the user. Also known as a container. *See also* mirror set (RAID 1); multilevel array; RAID 3 set; RAID 4 set; RAID 5 set; stripe set (RAID 0); stripe set of mirror sets (RAID 0/1); stripe set of RAID 5 sets (RAID 0/5); volume set.

active-active
Active-active mode is when two controllers in a storage system cooperate to provide redundancy. If one controller fails, the remaining controller will take over the failed controller's functionality. To accomplish this, each controller has two host ports (SCSI or fibre channel); one of which is normally active, the other is normally passive. In a failed-over configuration, the passive port becomes active and assumes the identity of the failed controller. In active-active mode, arrays can be accessed only by the controller that currently owns them. One controller will have no visibility to the other controller's arrays. If a controller fails, the surviving controller will take ownership of all arrays. Disk drives in the spare pool and unassigned disk drives are visible to both controllers. *See also* storage system.

B

bus
See channel.

C

channel
Any path used for the transfer of data and the control of information between storage devices and a storage controller. Each controller's channels are identified by a number. They are numbered in Storage Manager Pro starting with number 1. Also known as a bus.

chunk
A contiguous set of data written onto a single disk drive when a stripe set, RAID 5 set, or stripe set of mirror sets distributes, or stripes, data across its respective disk drives. See also *See also* RAID 5 set; stripe set (RAID 0); stripe set of mirror sets (RAID 0/1); stripe set of RAID 5 sets (RAID 0/5).

chunk size
See stripe size.

container
See array.

controller
A hardware device that performs I/O functions. Controllers also perform other functions such as read and write caching and RAID management. Also known as an adapter, embedded storage controller, or subsystem.

controller 0 and controller 1
When an external systems is in active-active mode, one controller is designated as controller "0" and the other controller is designated as controller "1". Controller identity is determined by the enclosure's hardware. Sometimes referred to as "A" controller and "B" controller. *See also* storage system; preferred controller.

D

device
Any type of physical computer storage unit such as a disk drive, controller, or enclosure.

device ID
See SCSI ID.

device slot
See slot.

directory manager
When setting up remote access to systems on your network, the directory manager is the system that other systems register with and that stores a list of all systems in the management set. *See also* management set.

disk array
See array.

disk drive
A physical disk drive on a SCSI bus. In Storage Manager Pro, disk drives are addressed by their disk ID, which includes the channel (bus) number, SCSI ID, and LUN. *See also* channel; disk ID; LUN; SCSI ID.

disk ID
Unique disk identifier that consists of the channel (bus) number, SCSI ID (also known as target ID), and LUN (logical unit number). For example, 1:04:0. *See also* channel; LUN; SCSI ID.

E

enclosure
A physical housing for disk drives, which can be connected externally to a computer. An enclosure usually contains one or more power supplies, fans, and temperature sensors. The term enclosure also applies to a SAF-TE- or SES-compliant backplane. *See also* SAF-TE.

enclosure ID
Enclosures that are controlled by a SAF-TE or SES processor are identified by an enclosure ID. The enclosure ID consists of the channel (bus) number, SCSI ID (also known as target ID), and LUN (Bus:ID:LUN). For example, 1:04:0. *See also* channel; LUN; SCSI ID.

enclosure management device
See enclosure.

F

fabric
A fibre channel (FC) network that includes switches. It is one of the basic topologies of a FC network. *See* fibre channel (FC).

failback
When a storage system is in active-active mode, failback is the act of returning ownership of controller resources from a surviving controller to a previously failed (but now active) controller. The resources include disk arrays, cache data, and host ID information. *See also* storage system.

failover
The process by which the controller rebuilds data onto a spare disk drive when a disk drive that is part of a redundant array fails. When a storage system is in active-active mode, failover is the act of temporarily transferring ownership of controller resources from a failed controller to a surviving controller. The resources include disk arrays, cache data, and host ID information.

FC device
A device that uses fibre channel (FC) communications. This technology currently supports both copper and optical cabling with speeds of 1 Gbps and 2 Gbps.

FC port
The connector on a router or device that provides a connection to a fibre channel (FC) network.

fibre
A generic fibre channel (FC) term that refers to all transmission media types specified in the FC Physical Layer standard (FC-PH), such as optical fiber, copper twisted pair, and copper coaxial cable.

fibre channel (FC)
A bidirectional, point-to-point serial data channel, structured for high-performance capability. In the physical sense, FC is an interconnection of multiple communication points, called N_Ports, by a switching network (fabric). FC transports incoming data from devices by reading the buffer information, packaging it, and sending the information across the fabric. Although FC is a generalized transport mechanism that has no protocol of its own or native I/O command set, it can transport any existing upper-level protocol such as SCSI and IP. FC offers high-speed data transfer rates up to 2 Gbps. FC is most commonly used to connect clustered servers to storage systems. ANSI has developed standards for FC.

file system
A layer of software that manages a collection of files within a directory structure. Storage Manager Pro supports three types of file systems on Windows NT/2000 systems: FAT, NTFS, and FAT32 (Windows 2000 only).

forced reset (kill)
When a storage system is in active-active mode, one controller can force a reset (also known as kill) on the other controller by resetting it and taking it offline. *See also* storage system.

free space
The space on an initialized disk drive that is not being used by an array. Arrays are created from free space. When an array is deleted, its space is returned to free space. *See also* array.

H

host bus adapter (HBA)
An HBA is the critical link between a host server or workstation and a storage subsystem, integrating computing platforms, operating systems, and I/O protocols to ensure proper interoperability and functionality. The HBA provides direct storage connectivity from the system to data within the storage subsystem and enables stable, high-speed transmission of information and files. HBAs manage the controller-specific aspects of handling a storage driver interface device implemented as a target driver, which supports mass storage peripheral devices such as disks drives and tapes. A storage driver interface is used to implement SCSI and other storage device drivers. An HBA connects to the storage subsystem to the host computer and uses either fiber or copper media.

hot-swapping
Removing a component from a system and installing a new component while the power is on, the system is running, and without pausing I/O.

I

initiator
An initiator (host system) sends operation requests to be performed by a target device (peripheral). *See also* target.

J

JBOD
Just a Bunch of Disks. *See* volume set.

K

kill
See forced reset (kill).

L

logical unit number
See LUN.

loop address
A loop address is an fibre channel (FC) term that indicates the unique ID of a node in FC loop topology. A loop address is sometimes referred to as a Loop ID.

LUN
Stands for logical unit number. The number assigned to a subdevice (logical unit) of a SCSI device. Each SCSI device can contain up to 63 subdevices numbered 0 through 63; however, most SCSI devices contain only one subdevice (LUN 0). A fibre channel (FC) host using LUNs can address multiple peripheral devices that may share a common controller. On storage systems, each array is assigned and accessed by its own LUN.

M

management set
Group of two or more systems on your network that can use Storage Manager Pro to manage each other's storage devices. *See also* directory manager.

mirror set (RAID 1)
An array type made up of two equal-sized partitions that reside on two different disk drives. A mirror set stores and maintains the same (redundant) data in each of the two partitions. *See also* partition; redundancy.

multilevel array
An array that contains other arrays. *See also* array; stripe set of mirror sets (RAID 0/1); stripe set of RAID 5 sets (RAID 0/5).

P

parity
A form of error correcting redundancy used to re-create the data of a failed disk drive in a RAID 3, 4, or 5 set. *See also* RAID 3 set; RAID 4 set; RAID 5 set; redundancy.

partition
A subdivision of a disk or storage area. There are three main types of partitions:

1. A portion of a physical or virtual disk drive that functions as a separate unit. A single disk drive can be divided into several partitions, each of which the operating system sees as a separate device with its own volume name (such as D:, E:, F:, and so on). These partitions are usually created by the operating system.

2. Contiguous storage space produced during the RAID creation process. When a controller creates an array, it automatically converts some or all of the free space on a disk drive into one or more partitions.

These partitions are not seen by the operating system. Rather, they are the building blocks of a virtual disk. This virtual disk is seen by the operating system as a single disk drive.

Depending on the type of RAID array created, the virtual disk may be larger than any of its component partitions. For example, a stripe set (RAID 0) created from two partitions presents a virtual disk drive almost two times larger than the individual partitions. Each of these partitions can be used by only one array at a time.

3. A subdivision of a virtual disk. Some RAID controllers allow you to divide the virtual disk into multiple parts, or partitions. Each partition is seen by the operating system as a separate disk drive.free space.

point-to-point
A communication link between two end systems or between a host system and a target device. Generally, the point-to-point topology is one of three fibre channel (FC) topologies, in which two ports are directly connected by a link; there are no fabric, loop, or switching elements present.

preferred controller

When a storage system is in an active-active mode, a single controller has ownership of arrays and dedicated spares and is the preferred owner. If the controller fails, the other controller assumes temporary ownership of its resources. *See also* storage system.

R

RAID 0

See stripe set (RAID 0).

RAID 1

See mirror set (RAID 1).

RAID 0/1

See stripe set of mirror sets (RAID 0/1).

RAID 0/5

See stripe set of RAID 5 sets (RAID 0/5).

RAID 3 set

A RAID 3 set is an array made up of three or more disk drives. It uses parallel access, meaning all member disk drives participate concurrently in every I/O operation directed at the array. Each virtual disk drive I/O operation is subdivided and distributed (striped) across all data disk drives; therefore, it uses small stripe depth. Parity check data is stored on a separate parity disk drive. *See also* chunk; partition; parity.

RAID 4 set

A RAID 4 set is an array made up of three or more disk drives. Data blocks are distributed as with RAID 0 (disk striping). It differs from RAID 3 in two ways: 1) it normally uses independent access (rather than parallel access), meaning the array's disk drives may operate independently of each other allowing multiple simultaneous read and write operations, and 2) stripe depth is larger than the virtual disk drive average I/O size. Parity check data is stored on a separate parity disk drive. *See also* chunk; partition; parity.

RAID 5 set
A RAID 5 set is an array made up of at least three or more disk drives. It is similar to a RAID 4 set except that the parity check data is distributed among *all* of the disk drives rather than being stored on a separate disk drive. *See also* chunk; partition; parity.

RAID 50
See stripe set of RAID 5 sets (RAID 0/5).

redundancy
The capability of preventing data loss if a disk drive fails. Some array types give you this capability using one of two methods: two identical copies or parity.

release forced reset (unkill)
When a storage system is in active-active mode and a surviving controller removes the reset from the other controller, it releases it from a forced reset (also known as *unkill*). The other controller will reboot and attempt to come online. *See also* storage system.

S

SAF-TE
Stands for SCSI Accessed Fault-Tolerant Enclosure. The SAF-TE specification is an open specification designed to provide a comprehensive standardized method to monitor and report status information on the condition of disk drives, power supplies, cooling systems, and other components used in high-availability LAN servers and storage subsystems. *See also* enclosure.

SES
Stands for SCSI Enclosure Services. SES enclosures support management similar to SAF-TE enclosures. SES is a SCSI-3 specification. *See also* enclosure; SAF-TE.

SCSI bus
A SCSI bus provides a means of transferring data between SCSI devices. A SCSI bus is either an 8- or 16-bit bus that supports up to 8 or 16 devices, including itself. The bus can consist of any mix of initiators and targets, with the requirement that at least one initiator and one target must be present.

SCSI channel termination
See termination.

SCSI device
A single unit on a SCSI bus that originates or services SCSI commands. A SCSI device is identified by a unique SCSI address. SCSI devices can act as initiators or targets.

SCSI ID
The number assigned to each SCSI device attached to a SCSI channel. Each device has its own unique SCSI ID. Also known as the target ID or SCSI address. *See also* channel; disk ID; enclosure ID.

slot
A receptacle in an enclosure for inserting and removing a SCSI device. *See also* enclosure.

SMART
Stands for Self-Monitoring Analysis and Reporting Technology. This technology is designed to determine the reliability status of a disk drive. If the SMART system determines that a disk drive failure is imminent, the user is notified and advised of the appropriate action to take.

small computer system interface (SCSI)
SCSI is an industry standard for connecting peripheral devices and their controllers to an initiator. Storage devices are daisy-chained together and connected to a host adapter. The host adapter provides a shared bus that attached peripherals use to pass data to and from the host system. Examples of devices attached to the adapter include disk drives, CD-ROM drives, optical disks drives, and tape drives. In theory, any SCSI device can be plugged into any SCSI controller.

spare
A disk drive that you designate as a replacement disk drive as part of the spare pool. If a disk drive in a redundant array fails, the controller looks for a spare disk drive on which to rebuild the data of the failed disk drive.

spare pool
One or more disk drives that you designate as replacements for any arrays on a controller.

stand-alone
Stand-alone configuration refers to a storage system in which the controller operates autonomously.

storage area network (SAN)
SAN is a dedicated network for storage data traffic that links one or more servers to one or more storage systems. Each storage system could be RAID, tape backup, tape library, CD-ROM library, or JBOD. SANs operate with both SCSI and networking (IP) protocols. Servers and workstations use the Fibre Channel (FC) network for shared data access to the same storage device or system. Legacy SCSI systems are interfaced using an FC-to-SCSI bridge.

storage system
A storage system is when the RAID controller resides outside of the host system enclosure. The storage system is controlled from the host system using Storage Manager Pro. Since the controller is accessed using standard SCSI protocols, the need for specific operating system drivers is eliminated. Some external RAID controllers can be configured with single or dual host channels and can support either stand-alone mode, or as an active-active failover pair. *See also* active-active; stand-alone.

stripe set (RAID 0)
An array type that is made up of two or more drives. The stripe set distributes, or stripes, data evenly across its respective disk drives in equal-sized sections called chunks. *See also* chunk; partition.

stripe set of mirror sets (RAID 0/1)
An array type that is made up of two or more equal-sized mirror sets. The data in a stripe set of mirror sets is redundant. *See also* mirror set (RAID 1); multilevel array.

stripe set of RAID 5 sets (RAID 0/5)
An array type that is made up of two or more equal-sized RAID 5 sets. The data in a stripe set of RAID 5 sets is redundant. *See also* RAID 5 set; multilevel array.

stripe size
Amount of data written to one partition before the controller moves to the next partition in a stripe set.

T

target
A target is a device (peripheral) that responds to an operation requested by an initiator (host system). *See also* initiator.

target ID
See SCSI ID.

termination
Termination (also known as a terminator block) refers to the electrical connection at each end of a SCSI bus. The function of a terminator block is to provide for a proper electrical transmission of the data across the cable. SCSI buses require that a terminator be placed on the output SCSI connector on the last SCSI peripheral. Data errors may occur in a SCSI bus that is not terminated.

topology
A network topology refers to the physical layout of nodes on a network. Fibre channel (FC) topologies include point-to-point, FC-AL, and fabric. *See* release forced reset (unkill).

V

verify
A function of the RAID controller that insures the redundant data is consistent with the data. For a mirror set, the system ensures that the data on the two disk drives is consistent. For an array type that uses parity for the redundancy, it checks the parity and fixes any parity errors.

volume set
An array type that is a concatenation (combination) of one or more partitions on one or more disk drives. The partitions in a volume set do not have to be the same size. *See also* partition.

Z

zero
A function that writes zeroes in every data block of an array or disk drive. Using Zero permanently deletes all data from the array or disk drive.

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